THE

POPULAR SCIENCE MONTHLY.

DECEMBER, 1884.

THE REFORMATION IN TIME-KEEPING.

By W. F. ALLEN.

ON November 19, 1883, the daily papers of the United States and Canada, from the Atlantic Ocean to the Rocky Mountains, contained more or less elaborate accounts of the change from local to "standard time" which had been made on the previous day. Comparatively few among the millions of people who read these accounts took the trouble to investigate the actual meaning of the change or the arguments in its favor. It appeared to be the work of practical railway managers, and to be favored by leading scientists. Watch-makers agreed to and aided the change, and few other persons were apparently interested. So the people quietly acquiesced, reset their watches a few minutes faster or slower, and for the most part soon forgot that any but "standard time" had ever been in use.

In the present generation we have become so accustomed to the use of accurate time and the ready means of obtaining it, that we hardly realize how dependent we are upon it. Were it possible to suddenly destroy all clocks and watches in any given center of population among civilized nations, while all other surroundings of modern development remained as before, we can scarcely conceive of the endless confusion that would arise. Only by contemplating the results of such a catastrophe can we fully understand what an important part the knowledge of accurate time plays in our every-day affairs.

Man shares with the inferior animals the knowledge and the use of the simplest and earliest division of time into day and night, and in a more restricted sense into seasons. The division of the day into minor parts has been developed by man as necessity or convenience required. It has not been many years since watches were made with

hour-hands only, and the general use of the finer divisions into minutes and seconds is almost entirely the outgrowth of the requirements of modern civilization. Astronomical time-keeping is not here considered. By the Babylonian system of dividing the day, which was used by the Jews and other Oriental nations, the time between sunrise and sunset was portioned into twelve equal parts at all seasons of the year, the hour varying in length with the season. If this method of division still prevailed, the hours in New York city would vary in length from about forty-six to about seventy-five of our present minutes. In the Arctic regions the inapplicability of this system to general use would reach its climax of absurdity.

The general facts upon which all systems of time-keeping are based are commonly understood, but the details are seldom referred to.

The most primitive kind of timepiece is a sun-dial. Reduced to its simplest form, a sun-dial consists of a straight pole erected upon a permanently fixed circular plate, the shadow of the pole indicating midday when it coincides with a line drawn due north from the base of the pole, the pole being erected upon a line parallel with the axis of the earth. The other hours of the day are indicated by marks upon the circular plate upon which the shadow of the pole successively falls.

When the sun-dial was invented can not be stated. It was of very ancient origin, and is mentioned in the thirty-eighth chapter of Isaiah. The clepsydra, or water-clock, and the hour-glass, although very ancient, must from their nature have been invented subsequent to the sun-dial. But sun-dials, of which there are about a dozen different kinds, although common, were never in such general use as clocks are in modern times, and were philosophical rather than popular instruments. The clock was invented about 1379, and the pendulum as a regulating power in 1657.

The rapid development of the science of horology in the present century has been almost coincident with and in no small degree dependent upon the construction and operation of railway and telegraph lines. The needs of these great engines of modern civilization created a general demand for exactness in time reckoning which had never existed before. It was required both for the use of their employés and for the public which patronized their lines.

A sun-dial being stationary, when properly made and adjusted, exhibited solar time correctly, and a watch regulated from the dial by the equation of time would also be correct for that particular spot, but the moment the owner of the watch began to move east or west his time-piece no longer registered correct time, and when he traveled with the speed of a railway-train the error was rapidly exaggerated.

The necessity for exactness before mentioned, and the impossibility of adhering to local time, early attracted the attention of railway managers, and caused them much perplexity and annoyance. With the rapid construction of railway lines, the commingling of the various lo-

cal standards soon became decidedly intricate. Travelers were greatly inconvenienced by the lack of knowledge of the standard upon which the time of trains as advertised was based, and to such the situation was full of difficulties. Some of these difficulties were stated in an "open letter" published in "The Century" for September, 1883. The subject in its practical aspect also attracted the attention of scientists and scientific societies. It became a prominent topic of discussion at meetings of the American Metrological Society, the Association for the Advancement of Science, and the Society of Civil Engineers. Although astronomers use sidereal time, based upon the position of the stars, and not of the sun, in common with many other scientists they were generally warmly interested in the subject.

The local time kept by clocks is an average of solar time, and is properly designated "mean time," as distinguished from the variable time shown by the sun-dial. No clock or watch can be made to keep the time as shown by the sun-dial, and this new system of time-keeping, therefore, became necessary when clocks and watches were invented. The relation between mean and apparent time, and what is meant by "the equation of time," may be seen at a glance by reference to the accompanying diagram. Mean time being represented by the right line graduated for the several months of the year, the variation of apparent time is shown by the curved line entwined around it. In other words, a line drawn through the several positions of the sun at mean noon will describe the curves as indicated. For reasons which need not here be stated, the diagram will be found generally correct for one year only out of four; but, upon the scale by which the diagram is drawn, this error is infinitesimal. It is hardly necessary to state that the principal cause of the variation between mean and apparent time is "the obliquity of the ecliptic to the equinoctial."

Apparent time is about fifteen minutes slower than mean time about February 10th, and about sixteen minutes faster on October 27th. They agree about April 15th, June 15th, August 31st, and December 24th. If a well-regulated clock were set by apparent time on October 27th, it would be about thirty-one minutes faster than apparent time on the following February 10th. It will be seen that, under such circumstances, clock-time would vary as much from true sun-time as any clock set by the present system of standard time varies from mean time at the most extreme point.

The safe operation of a railway requires that the watches of all its employés upon, or who have occasion to refer to, the same trains should always indicate the same moment of time. Railway-time upon lines running east and west can of course never coincide with mean local time except at a single point, and the longer the line of the road the greater will be the variation. Before the recent change to standard time there were several cases where the railroad-time in use

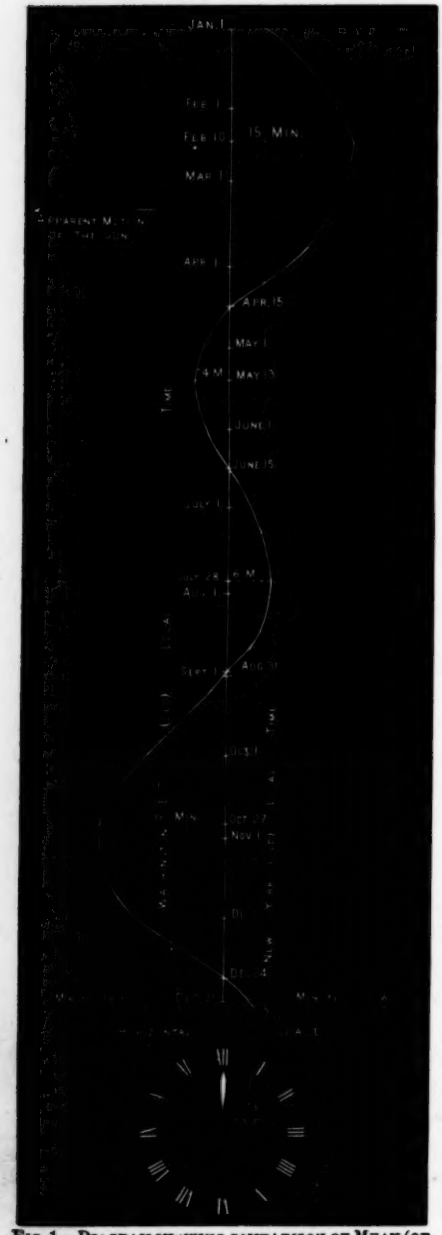


FIG 1.—DIAGRAM SHOWING COMPARISON OF MEAN (OR CLOCK) TIME WITH SOLAR (OR APPARENT) TIME, AT THE SEVERAL SEASONS OF THE YEAR. The perpendicular central line represents Mean Time, and the curved line Solar Time, at mean noon.

differed by more than half an hour from mean local time at various points. The inhabitants of the surrounding country at such points, having no standard of reference except the railway-clocks, accustomed themselves to and used railway-time without inconvenience, and in a number of instances, where the railway standard was changed from some cause, the people made the same change in their time-pieces. It was important in connection with railway-trains to keep exact time, and for all other purposes any relative time was sufficiently accurate.

In the early part of the year 1883 there were fifty-three standards of time in use on the railroads and by the people of the United States and Canada. These standards governed sections with no definite limits, and upon railroad lines were apparently inextricably mixed and interwoven. The condition of the matter was abnormal in numerous instances, there being no less than three hundred points where railroads, using different standards of time, crossed each other and exchanged traffic. At almost every city of importance several standards were used by the railways, and in some cases the city time differed from any of them. Local jealousies made the chance of effecting reform apparently hopeless. Many who warmly favored standard time regarded the reform as one unlikely to be soon accomplished.

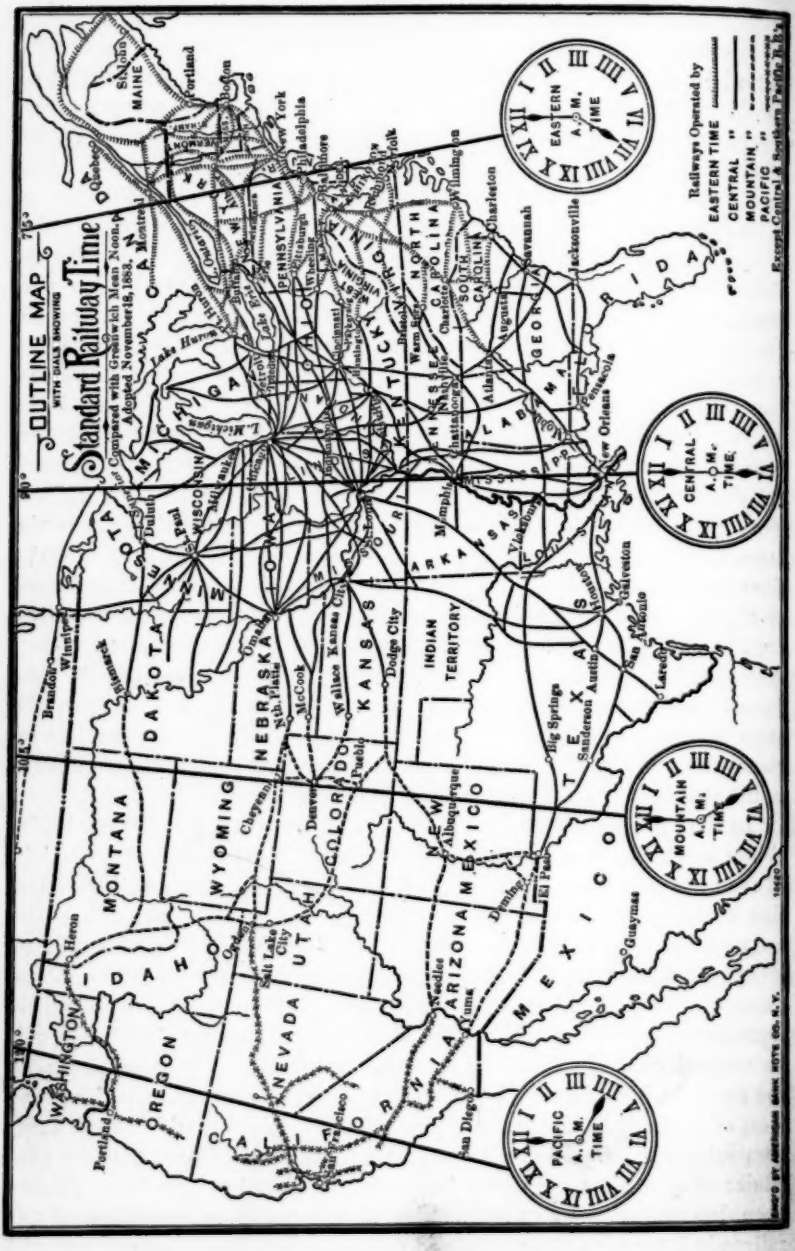
The solution of the problem necessarily required a close and long-

continued study of the peculiarities of the situation. Whatever change was proposed must affect as little as possible the relations which previously existed between railway lines and business communities.

A complete system of standard time was finally devised and submitted in April, 1883, to several railway conventions, assembled to consider other subjects, at which about fifty important companies were represented. The system proposed was deemed practicable, and recommended for adoption, by the railway officials present at these conventions. It involved the total abolition of the use of local time by the public, except at points situated on the governing meridians.

A theory of reform had been under consideration by scientific societies for years, and several systems of standard time had been proposed, founded upon this theory, without practical result. Many investigators of the problem among railway officials and scientists had independently arrived at the conclusion that this theory was the correct one. It was based upon the idea of grouping sections of the country together under the same standard with an even-hour difference between the standards of the adjoining groups. "Eastern standard time," which is the standard of the section in which Boston, New York City, Philadelphia, Washington, etc., are located, is simply the mean time of the seventy-fifth meridian west from Greenwich, and the time kept in all these cities is now precisely alike. The dotted lines on the right and left of the diagram represent the mean times formerly kept at New York city and Washington in their relation to "Eastern" standard time. If a curved line were projected on one of these dotted lines parallel with the curved line on the diagram, and at the same distance, its relation to the central perpendicular line would represent the relation which solar time at New York or Washington bears to the standard time of the seventy-fifth meridian.

In the various discussions of the question a difficulty arose in deciding upon the best governing meridian. Should it be Greenwich, Washington, or New York? Each had its advocates. If this question could be settled, a more serious one arose in determining the proper lines upon which the sections could be divided. The result of its adoption has proved that the system proposed in April, 1883, solved these questions satisfactorily. This system is now in force, and is represented in outline on the map which appears on page 150. It will be noticed that the dividing lines are irregular. Communities near the border which have adopted the system, use the standard east or west of their locations according to the direction in which their business interests lie. In other words, the question is determined by convenience of use, as questions in regard to time-keeping have always been determined. The peculiarities of ownership or operation of the railroads determine their points of change. Legislative enactment will doubtless ultimately define the precise boundaries of the sections of countries to be governed by each standard.


OUTLINE MAP
WITH DATA SHOWING
Standard Railway Time
Compared with Greenwich Mean Noon, Adopted November 18, 1883.
Railways Operated by
EASTERN TIME
CENTRAL "
MOUNTAIN "
PACIFIC "
Except Central & Southern Pacific R.R's
EASTERN A.M. TIME
CENTRAL A.M. TIME
MOUNTAIN A.M. TIME
PACIFIC A.M. TIME
MAINE
MONTANA
WYOMING
IDAHO
OREGON
WASHINGTON
NEVADA
UTAH
COLORADO
ARIZONA
NEW MEXICO
DAKOTA
NEBRASKA
KANSAS
INDIAN TERRITORY
TEXAS
MINNESOTA
WISCONSIN
MICHIGAN
ILLINOIS
INDIANA
OHIO
KENTUCKY
TENNESSEE
MISSISSIPPI
ARKANSAS
LOUISIANA
ALABAMA
GEORGIA
FLORIDA
SOUTH CAROLINA
NORTH CAROLINA
VIRGINIA
PENNSYLVANIA
NEW YORK
CALIFORNIA
Portland
San Francisco
Los Angeles
San Diego
Salt Lake City
Denver
Cheyenne
Omaha
Chicago
St. Paul
Duluth
Detroit
Cleveland
Buffalo
Pittsburgh
Philadelphia
New York
Boston
St. John
Montreal
Toronto
Portland
Bismarck
Huron
Yankton
Sioux City
Council Bluffs
Kansas City
St. Louis
Memphis
Vicksburg
New Orleans
Mobile
Pensacola
Jacksonville
Savannah
Charleston
Wilmington
Norfolk
Richmond
Washington
Baltimore
Wheeling
Columbus
Cincinnati
Indianapolis
Louisville
Nashville
Chattanooga
Atlanta
Augusta
Milwaukee
Madison
Winona
Dubuque
Des Moines
Omaha
Grand Island
North Platte
McCook
Wallace
Kansas City
Dodge City
Topeka
Atchison
Leavenworth
Pueblo
Big Springs
Sanderson
Austin
Galveston
San Antonio
Laredo
Albuquerque
El Paso
Deming
Guaymas
Mexico
Ogden
Heron
Spokane
Tacoma
Seattle
Yuma
Needles
Lake Huron
Lake Michigan
Lake Superior
Lake Erie
Lake Ontario
Gulf of Mexico
Pacific Ocean
Atlantic Ocean
Engraved by American Bank Note Co. N.Y.

The action of the railroad companies having been assured, the subsequent action on the part of city governments became possible as it could not have been otherwise. Of the labor and means employed to secure this action on the part of the railways and the cities it is unnecessary here to speak. They proved sufficient to accomplish very fully the end desired. More than eighty per cent of all the cities of over ten thousand inhabitants in the United States have adopted standard time.

The adoption of the new standard required a simultaneous change to be made in the railway-clocks and the watches of employés upon nearly every railroad in the United States and Canada, the change varying from one minute and three seconds on the Pennsylvania Railroad to forty-five minutes on the Intercolonial Railway of Canada. The exceptions were two roads in the vicinity of New Orleans, and a few lines in the vicinity of Denver. The change was also slight for some of the St. Louis roads. The Intercolonial Railway adopted the time of the seventy-fifth meridian as a matter of convenience, instead of that of the sixtieth meridian, to which its location would have properly assigned it. So perfect were the preparations that not a single accident at any point is recorded as having been caused by the change. On the day when the new standards took effect, the clocks of about twenty thousand railway-stations and the watches of three hundred thousand railway employés were reset. Hundreds, perhaps thousands, of city and town clocks were altered to conform. How many individuals reset their watches it is impossible to compute, but they could certainly be reckoned by millions. Probably no such singular incident has ever before happened, or is likely to occur again.

At the present time, from the Atlantic Ocean at the eastern extremity of New Brunswick, to the Pacific coast at Oregon, the minute-hands of the railway clocks and watches indicate the same minute of time at all hours, and fully fifty million people regulate their business affairs by standard time.

While a few and for the most part unimportant communities, and some railway companies, did not make the change immediately, so large a majority adopted the system on November 18, 1883, that that date may be fairly taken as the one upon which the reform took effect. Several New England railroads, the Central Vermont Railroad being the most important, commenced to run their trains by "Eastern" standard time on October 7, 1883. The Central and Southern Pacific Railroads west of Ogden and Deming, and their branch lines, are the only railroads in the United States or Canada which do not now use standard time, if we except two purely local roads in Pennsylvania, aggregating less than twenty miles in length. The last to adopt the system were the Union Pacific Railway and the city of Omaha, on May 1, 1884.

The legality of the use of standard time was established by the decision of Judge Holmes, of Massachusetts, that whatever time was in ordinary use by the people of any community was lawful time; and his decision is not likely to be reversed. From an economic standpoint it is difficult to perceive what difference it makes to a laboring-man whether he commences work at a time nominally called seven o'clock or half-past seven, so long as he receives full wages for a full day's work.

Some of the objections raised to the use of standard time as a substitute for local time are as amusing as the famous declaration of the Rev. John Jasper, of Richmond, Virginia. It is urged that the sun was divinely set to rule the day, and therefore to use any but solar time is akin to, if not actually, immoral conduct. As the moon was also set to rule the night, such persons, if logical, should obey that portion of the divine command also. The fact is, that solar time was necessarily abandoned when clocks came into general use, and time based upon one or another arbitrary standard has governed the civilized world ever since. The present system, with its widely extended uniformity, simply conforms to the principle of securing the greatest good to the greatest number, a principle which must everywhere in the end prevail.

AMERICAN ASPECTS OF ANTHROPOLOGY.*

By EDWARD B. TYLOR, D. C. L., F. R. S.

OUR newly-constituted Section of Anthropology, now promoted from the lower rank of a Department of Biology, holds its first meeting under remarkable circumstances. Here in America one of the great problems of race and civilization comes into closer view than in Europe. In England anthropologists infer from stone arrow-heads and hatchet-blades, laid up in burial-mounds or scattered over the sites of vanished villages, that Stone age tribes once dwelt in the land; but what they were like in feature and complexion, what languages they spoke, what social laws and religion they lived under, are questions where speculation has but little guidance from fact. It is very different when under our feet in Montreal are found relics of a people who formerly dwelt here, Stone age people, as their implements show, though not unskilled in barbaric arts, as is seen by the ornamentation of their earthen pots and tobacco-pipes, made familiar by the publications of Principal Dawson. As we all know, the record of Jacques Cartier, published in the sixteenth-century collection of Ramusio, proves

* Vice-President's address to the Section of Anthropology of the British Association at the Montreal meeting.

by text and drawing that here stood the famous palisaded town of Hochelaga. Its inhabitants, as his vocabulary shows, belonged to the group of tribes whose word for five is *wisk*—that is to say, they were of the Iroquois stock. Much as Canada has changed since then, we can still study among the settled Iroquois the type of a race lately in the Stone age, still trace remnants and records of their peculiar social institutions, and still hear spoken their language of strange vocabulary and unfamiliar structure. Peculiar importance is given to Canadian anthropology by the presence of such local American types of man, representatives of a stage of culture long passed away in Europe. Nor does this by any means oust from the Canadian mind the interest of the ordinary problems of European anthropology. The complex succession of races which makes up the pedigree of the modern Englishman and Frenchman, where the descendants perhaps of palæolithic, and certainly of neolithic, man have blended with invading Keltic, Roman, Teutonic-Scandinavian peoples—all this is the inheritance of settlers in America as much as of their kinsfolk who have staid in Europe. In the present scientific visit of the Old to the New World, I propose to touch on some prominent questions of anthropology with special reference to their American aspects. Inasmuch as in an introductory address the practice of the Association tends to make arguments unanswerable, it will be desirable for me to suggest rather than to dogmatize, leaving the detailed treatment of the topics raised to come in the more specialized papers and discussions which form the current business of the section.

The term *prehistoric*, invaluable to anthropologists since Professor Daniel Wilson introduced it more than thirty years ago, stretches back from times just outside the range of written history into the remotest ages where human remains or relics, or other more indirect evidence, justifies the opinion that man existed. Far back in these prehistoric periods, the problem of Quaternary man turns on the presence of his rude stone implements in the drift gravels and in caves, associated with the remains of what may be called for shortness the mammoth-fauna. Not to recapitulate details which have been set down in a hundred books, the point to be insisted on is how, in the experience of those who, like myself, have followed them since the time of Boucher de Perthes, the effect of a quarter of a century's research and criticism has been to give Quaternary man a more and more real position. The clumsy flint pick and its contemporary mammoth-tooth have become stock articles in museums, and every year adds new localities where palæolithic implements are found of the types catalogued years ago by Evans, and in beds agreeing with the sections drawn years ago by Prestwich. It is generally admitted that about the close of the Glacial period savage man killed the huge maned elephants, or fled from the great lions and tigers on what was then forest-clad valley-bottom, in ages before the later water-flow had cut out the present wide

valleys fifty or one hundred feet or more lower, leaving the remains of the ancient drift-beds exposed high on what are now the slopes. To fix our ideas on the picture of an actual locality, we may fancy ourselves standing with Mr. Spurrell on the old sandy beach of the Thames near Crayford, thirty-five feet above where the river now flows two miles away in the valley. Here we are on the very workshop-floor where palæolithic man sat chipping at the blocks of flint which had fallen out of the chalk-cliff above his head. There lie the broken remains of his blocks, the flint-chips he knocked off, and which can be fitted back into their places, the striking-stones with which the flaking was done; and with these the splintered bones of mammoth and tichorhine rhinoceros, possibly remains of meals. Moreover, as if to point the contrast between the rude palæolithic man who worked these coarse blocks, and apparently never troubled himself to seek for better material, the modern visitor sees within fifty yards of the spot the bottle-shaped pits dug out in later ages by neolithic man through the soil to a depth in the chalk where a layer of good workable flint supplied him with the material for his neat flakes and trimly-chipped arrow-heads. The evidence of caverns such as those of Devonshire and Périgord, with their revelations of early European life and art, has been supplemented by many new explorations, without shaking the conclusion arrived at as to the age known as the reindeer period of the northern half of Europe, when the mammoth and cave-bear and their contemporary mammals had not yet disappeared, but the close of the Glacial period was merging into the times when in England and France savages hunted the reindeer for food as the Arctic tribe of America do still. Human remains of these early periods are still scarce and unsatisfactory for determining race-types. Among the latest finds is part of a skull from the loess at Potbaba, near Prague, with prominent brow-ridges, though less remarkable in this way than the celebrated Neanderthal skull. It remains the prevailing opinion of anatomists that these very ancient skulls are not apt to show extreme lowness of type, but to be higher in the scale than, for instance, the Tasmanian. The evidence increases as to the wide range of palæolithic man. He extended far into Asia, where his characteristic rude stone implements are plentifully found in the caves of Syria and the foot-hills of Madras. The question which this section may have especial means of dealing with is whether man likewise inhabited America with the great extinct animals of the Quaternary period, if not even earlier.

Among the statements brought forward as to this subject, a few are mere fictions, while others, though entirely genuine, are surrounded with doubts, making it difficult to use them for anthropological purposes. We shall not discuss the sandaled human giants, whose foot-prints, twenty inches long, are declared to have been found with the foot-prints of mammoths, among whom they walked, at Carson, Nevada. There is something picturesque in the idea of a man in a past

geological period finding on the Pampas the body of a glyptodon, scooping out its flesh, setting up its carapace on the ground like a monstrous dish-cover, and digging himself a burrow to live in underneath this animal roof; but geologists have not accepted the account. Even in the case of so well-known an explorer as the late Dr. Lund, opinions are still divided as to whether his human skulls from the caves of Brazil are really contemporary with the bones of megatherium and fossil horse. One of the latest judgments has been favorable: Quatrefages not only looks upon the cave-skulls as of high antiquity, but regards their owners as representing the ancestors of the living Indians. The high and narrow dimensions of the ancient and modern skulls are given in the "Crania Ethnica," and, whatever a similarity of proportions between them may prove, it certainly exists. Dr. Koch's celebrated flint arrow-head, recorded to have been found under the leg-bones of a mastodon in Missouri, is still to be seen, and has all the appearance of a modern Indian weapon, which raises doubt of its being really of the mastodon period. This antecedent improbability of remote geological age is felt still more strongly to attach to the stone pestles and mortars, etc., brought forward by Mr. J. D. Whitney, of the California Geological Survey, as found by miners in the gold-bearing gravels. On the one hand, these elaborate articles of stone-work are the very characteristic objects of the Indian graves of the district, and on the other the theory that the auriferous gravels capped by lava-flows are of Tertiary age is absolutely denied by geologists such as M. Jules Marcou in his article on "The Geology of California" ("Bull. Soc. Géol. de France," 1883). It is to be hoped that the section may have the opportunity of discussing Dr. C. C. Abbott's implements from Trenton, New Jersey. The turtle-back celts, as they are called from their flat and convex sides, are rudely chipped from pebbles of the hard argillite out of the bowlder-bed, but the question is as to the position of the sand and gravel in which they are found in the bluffs high above the present Delaware River. The first opinion come to, that the makers of the implements inhabited America not merely after but during the great Ice age, has been modified by further examination, especially by the report of Mr. H. Carvill Lewis, who considers the implement-bearing bed not to have been deposited by a river which flowed over the top of the bowlder-bed, but that, at a later period than this would involve, the Delaware had cut a channel through the bowlder-bed, and that a subsequent glacier-flood threw down sand and gravel in this cutting at a considerable height above the existing river, burying therein the rude stone implements of an Esquimau race then inhabiting the country. Belt, Wilson, and Putnam have written on this question, which I will not pursue further, except by pointing out that the evidence from the bluffs of the Delaware must not be taken by itself, but in connection with that from the terraces high above the James River, near Richmond, where Mr. C. M. Wallace has like-

wise reported the finding of rude stone instruments, to which must be added other finds from Guanajuato, Rio Juchipila, and other Mexican localities.

This leads at once into the interesting argument how far any existing people are the descendants and representatives of man of the post-Glacial period. The problem whether the present Esquimaux are such a remnant of an early race is one which Professor Boyd Dawkins has long worked at, and will, I trust, bring forward with full detail in this appropriate place. Since he stated this view in his work on "Cave-Hunting" it has continually been cited, whether by way of affirmation or denial, but always with that gain to the subject which arises from a theory based on distinct facts. May I take occasion here to mention as preliminary the question, were the natives met with by the Scandinavian seafarers of the eleventh century Esquimaux, and whereabout on the coast were they actually found? It may be to Canadians a curious subject of contemplation how about that time of history Scandinavia stretched out its hands at once to their old and their new home. When the race of bold sea-rovers who ruled Normandy and invaded England turned their prows into the northern and western sea, they passed from Iceland to yet more inclement Greenland, and thence, according to Icelandic records, which are too consistent to be refused belief as to main facts, they sailed some way down the American coast. But where are we to look for the most southerly points which the sagas mention as reached in Vineland? Where was Keel-ness, where Thorvald's ship ran aground, and Cross-ness, where he was buried, when he died by the *skräling's* arrow? Rafn, in the "Antiquitates Americanæ," confidently maps out these places about the promontory of Cape Cod, in Massachusetts, and this has been repeated since from book to book. I must plead guilty to having cited Rafn's map before now, but when with reference to the present meeting I consulted our learned editor of Scandinavian records at Oxford, Mr. Gudbrand Vigfusson, and afterward went through the original passages in the sagas with Mr. York Powell, I am bound to say that the voyages of the Northmen ought to be reduced to more moderate limits. It appears that they crossed from Greenland to Labrador (Helluland), and thence sailing more or less south and west, in two stretches of two days each they came to a place near where wild grapes grew, whence they called the country Vineland. This would, therefore, seem to have been somewhere about the Gulf of St. Lawrence, and it would be an interesting object for a yachting-cruise to try down from the east coast of Labrador a fair four days' sail of a viking-ship, and identify, if possible, the sound between the island and the *ness*, the river running out of the lake into the sea, the long stretches of sand, and the other local features mentioned in the sagas. While this is in the printer's hands, I hear that a paper somewhat to this same effect may come before the Geographical Section, but the matter concerns us here as bearing on the southern

limit of the Esquimaux. The *skrälings* who came on the sea in skin canoes (*hudhkeipr*), and hurled their spears with slings (*valslöngva*), seem by these very facts to have been probably Esquimaux, and the mention of their being swarthy, with great eyes and broad cheeks, agrees tolerably with this. The statement usually made that the word *skräling* meant "dwarf" would, if correct, have settled the question; but, unfortunately, there is no real warrant for this etymology. If we may take it that Esquimaux eight hundred years ago, before they had ever found their way to Greenland, were hunting seals on the coast of Newfoundland, and caribou in the forest, their life need not have been very unlike what it is now in their Arctic home. Some day, perhaps, the St. Lawrence and Newfoundland shores will be searched for relics of Esquimau life, as has been done with such success in the Aleutian Islands by Mr. W. H. Dall, though on this side of the continent we can hardly expect to find, as he does, traces of long residence and rise from a still lower condition.

Surveying now the vast series of so-called native, or indigenous, tribes of North and South America, we may admit that the fundamental notion on which American anthropology has to be treated is its relation to Asiatic. This kind of research is, as we know, quite old, but the recent advances of zoölogy and geology have given it new breadth as well as facility. The theories which account for the wide-lying American tribes, disconnected by language as they are, as all descended from ancestors who came by sea in boats, or across Behring Strait on the ice, may be felt somewhat to strain the probabilities of migration, and are likely to be remodeled under the information now supplied by geology as to the distribution of animals. It has become a familiar fact that the *Equidæ*, or horse-like animals, belong even more remarkably to the New than to the Old World. There was plainly land-connection between America and Asia, for the horses whose remains are fossil in America to have been genetically connected with the horses reintroduced from Europe. The deer may have passed from the Old World into North America in the Pliocene period; and the opinion is strongly held that the camels came the other way, originating in America and spreading thence into Asia and Africa. The mammoth and the reindeer did not cross over a few thousand years ago by Behring Strait, for they had been since Pleistocene times spread over the north of what was then one continent. To realize this ancient land-junction of Asia and America, this "Tertiary bridge," to use Professor Marsh's expression, it is instructive to look at Mr. Wallace's chart of the present soundings, observing that an elevation of under two hundred feet would make Behring Strait land, while moderately shallow sea extends southward to about the line of the Aleutian Islands, below which comes the plunge into the ocean-depths. If, then, we are to consider America as having received its human population by ordinary migration of successive tribes along this high-

way, the importance is obvious of deciding how old man is in America, and how long the continent remained united with Asia, as well as how these two difficult questions are bound up together in their bearing on anthropology. Leaving them to be settled by more competent judges, I will only point out that the theory of northern migration on dry land is, after all, only a revival of an old opinion, which came naturally to Acosta in the sixteenth century, because Behring Strait was not yet known of, and was held by Buffon in the eighteenth because the zoölogical conditions compelled him to suppose that Behring Strait had not always been there. Such a theory, whatever the exact shape it may take, seems wanted for the explanation of that most obvious fact of anthropology, the analogy of the indigenes of America with Asiatics, and more specifically with East and North Asiatics or Mongoloids. This broad race-generalization has thrust itself on every observer, and each has an instance to mention. My own particular instance is derived from inspection of a party of Botocudo Indians lately exhibited in London, who in proper clothing could have passed without question as Thibetans or Siamese. Now, when ethnologists like Dr. Pickering remark on the South Asiatic appearance of Californian tribes, it is open to them to argue that Japanese sailors of junks wrecked on the coast may have founded families there. But the Botocudos are far south and on the other side of the Andes, rude dwellers in the forests of Brazil, and yet they exhibit in an extreme form the Mongoloid character which makes America to the anthropologist part and parcel of Asia. Looked at in this light, there is something suggestive in our still giving to the natives of America the name of Indians; the idea of Columbus that the Caribs were Asiatics was not so absurd, after all.

It is perhaps hardly needful now to protest against stretching the generalization of American uniformity too far, and taking literally Humboldt's saying that he who has seen one American has seen all. The common character of American tribes, from Hudson's Bay to Tierra del Fuego, though more homogeneous than on any other tract of the world of similar extent, admits of wide sub-variation. How to distinguish and measure this sub-variation is a problem in which anthropology has only reached unsatisfactory results. The broad distinctions which are plainly seen are also those which are readily defined, such as the shape of the nose, curve of the lips, or the projection of the cheek-bones. But all who have compared such American races as Aztecs and Ojibways must be sensible of extreme difficulty in measuring the proportions of an average facial type. The attempt to give in a single pair of portraits a generalized national type has been tried —for instance, in the St. Petersburg set of models of races at the Exhibition of 1862. But done merely by eye, as they were, they were not so good as well-chosen individual portraits. It would be most desirable that Mr. Francis Galton's method of photographs, superposed

so as to combine a group of individuals into one generalized portrait, should have a thorough trial on groups of Iroquois, Aztecs, Caribs, and other tribes who are so far homogeneous in feature as to lend themselves to form an abstract portrait. A set of American races thus "Galtonized" (if I may coin the term) would very likely be so distinctive as to be accepted in anthropology. Craniological measurement has been largely applied in America, but unfortunately it was set wrong for years by the same misleading tendency to find a uniformity not really existent. Those who wish to judge Morton's dictum applied to the Scioto mound skull, "the perfect type of Indian conformation, to which the skulls of all the tribes from Cape Horn to Canada more or less approximate," will find facts to the contrary set forth in chapter xx of Wilson's "Prehistoric Man," and in Quatrefages and Hamy, "Crania Ethnica." American crania really differ so much that the hypothesis of successive migrations has been brought in to account for the brachycephalic skulls of the mound-builders as compared with living Indians of the district. Among minor race-divisions, as one of the best established may be mentioned that which in this district brings the Algonquin and Iroquois together into the dolichocephalic division; yet even here some divide the Algonquins into two groups by their varying breadth of skull. What may be the interpretation of the cranial evidence as bearing on the American problem it would be premature to say; at present all that can be done is to systematize facts. It is undisputed that the Esquimaux in their complexion, hair, and features approximate to the Mongoloid type of North Asia; but when it comes to cranial measurement the Esquimaux with their narrower skulls, whose proportion of breadth to length is only seventy-five to eighty, are far from conforming to the broad-skulled type of North Asiatic Mongoloids, whose average index is toward eighty-five. Of this divergence I have no explanation to offer; it illustrates the difficulties which have to be met by a young and imperfect science.

To clear the obscurity of race-problems, as viewed from the anatomical standing-point, we naturally seek the help of language. Of late years the anthropology of the Old World has had ever-increasing help from comparative philology. In such investigations, when the philologist seeks a connection between the languages of distant regions, he endeavors to establish both a common stock of words and a common grammatical structure. For instance, this most perfect proof of connection has been lately adduced by Mr. R. H. Codrington in support of the view that the Melanesians and Polynesians, much as they differ in skin and hair, speak languages which belong to a common stock. A more adventurous theory is that of Lenormant and Sayce, that the old Chaldean language is connected with the Tartar group; yet even here there is an *a priori* case based at once on analogies of dictionary and grammar. The comparative method becomes

much weaker when few or no words can be claimed as similar, and the whole burden of proof has to be borne by similar modes of word-formation and syntax, as, for example, in the researches of Aymonier and Keane tending to trace the Malay group of languages into connection with the Khmer or Cambodian. Within America the philologist uses with success the strong method of combined dictionary and grammar in order to define his great language-groups, such as the Algonquin extending from Hudson's Bay to Virginia, the Athapascan from Hudson's Bay to New Mexico, both crossing Canada in their vast range. But attempts to trace analogies between lists of words in Asiatic and American languages, though they may have shown some similarities deserving further inquiry, have hardly proved an amount of correspondence beyond what chance coincidence would be capable of producing. Thus, when it comes to judging of affinities between the great American language-families, or of any of them with the Asiatic, there is only the weaker method of structure to fall back on. Here the Esquimau analogy seems to be with North Asiatic languages. It would be defined as agglutinative-suffixing, or, to put the definition practically, an Esquimau word of however portentous length is treated by looking out in the dictionary the first syllable or two, which will be the root, the rest being a string of modifying suffixes. The Esquimau thus presents in an exaggerated form the characteristic structure of the vast Ural-Altaic or Turanian group of Asiatic languages. In studying American languages as a whole, the first step is to discard the generalization of Duponceau as to the American languages from Greenland to Cape Horn being united together, and distinguished from those of other parts of the world, by a common char. acter of polysynthetism, or combining whole sentences into words. The real divergences of structure in American language-families are brought clearly into view in the two dissertations of M. Lucien Adam, which are the most valuable papers of the Congrès International des Americanistes. Making special examination of sixteen languages of North and South America, Adam considers these to belong to a number of independent or irreducible families, as they would have been, he says, "had there been primitively several human couples." It may be worth suggesting, however, that the task of the philologer is to exhaust every possibility of discovering connections between languages before falling back on the extreme hypothesis of independent origins. These American language-families have grammatical tendencies in common, which suggest original relationship, and in some of these even correspond with languages of other regions in a way which may indicate connection rather than chance. For instance, the distinction of gender, not by sex as male and female, but by life as animate and inanimate, is familiar in the Algonquin group; in Cree *muskesin* = shoe (moccasin) makes its plural *muskesinâ*, while *eskwayû* = woman (squaw) makes its plural *eskwaywuk*. Now, this kind of gen-

der is not peculiar to America, but appears in Southeast Asia, as for instance in the Kol languages of Bengal. In that Asiatic district also appears the habit of infixing, that is, of modifying roots or words by the insertion of a letter or syllable, somewhat as the Dakota language inserts a pronoun within the verb-root itself, or as that remarkable language, the Choctaw, alters its verbs by insertions of a still more violent character. Again, the distinction between the inclusive and exclusive pronoun *we*, according as it means "you and I" or "they and I," etc. (the want of which is perhaps a defect in English), is as familiar to the Maori as to the Ojibway. Whether the languages of the American tribes be regarded as derived from Asia or as separate developments, their long existence on the American Continent seems unquestionable. Had they been the tongues of tribes come within a short time by Behring Strait, we should have expected them to show clear connection with the tongues of their kindred left behind in Asia, just as the Lapp in Europe, whose ancestors have been separated for thousands of years from the ancestors of the Ostiak or the Turk, still shows in his speech the traces of their remote kinship. The problem how tribes so similar in physical type and culture as the Algonquins, Iroquois, Sioux, and Athapascans, should adjoin one another, yet speaking languages so separate, is only soluble by influences which have had a long period of time to work in.

The comparison of peoples according to their social framework of family and tribe has been assuming more and more importance since it was brought forward by Bachofen, McLennan, and Morgan. One of its broadest distinctions comes into view within the Dominion of Canada. The Esquimaux are patriarchal, the father being head of the family, and descent and inheritance following the male line. But the Indian tribes farther south are largely matriarchal, reckoning descent not on the father's but the mother's side. In fact, it was through becoming an adopted Iroquois that Morgan became aware of this system, so foreign to European ideas, and which he supposed at first to be an isolated peculiarity. No less a person than Herodotus had fallen into the same mistake over two thousand years ago, when he thought the Lykians, in taking their names from their mothers, were unlike all other men. It is now, however, an accepted matter of anthropology, that in Herodotus's time nations of the civilized world had passed through this matriarchal stage, as appears from the survivals of it retained in the midst of their newer patriarchal institutions. For instance, among the Arabs to this day, strongly patriarchal as their society is in most respects, there survives that most matriarchal idea that one's nearest relative is not one's father but one's maternal uncle; he is bound to his sister's children by a "closer and holier tie" than paternity, as Tacitus says of the same conception among the ancient Germans. Obviously great interest attaches to any accounts of existing tribes which preserve for us the explanation of such social phe-

nomena. Some of the most instructive of these are too new to have yet found their way into our treatises on early institutions; they are accounts lately published by Dutch officials among the non-Islamized clans of Sumatra and Java. G. A. Wilken, "Over de Verwantschap en het Huwelijks en Erfrecht bij de Volken van den Indischen Archipel," summarizes the account put on record by Van Hasselt as to the life of the Malays of the Padang Highlands of Mid-Sumatra, who are known to represent an early Malay population. Among these people not only kinship but habitation follows absolutely the female line, so that the numerous dwellers in one great house are all connected by descent from one mother, one generation above another, children, then mothers and maternal uncles and aunts, then grandmothers and maternal great-uncles and great-aunts, etc. There are in each district several *suku* or mother-clans, between persons born in which marriage is forbidden. Here, then, appear the two well-known rules of female descent and exogamy, but now we come into view of the remarkable state of society, that, though marriage exists, it does not form the household. The woman remains in the maternal house she was born in, and the man remains in his; his position is that of an authorized visitor; if he will, he may come over and help her in the rice-field, but he need not; over the children he has no control whatever, and were he to presume to order or chastise them, their natural guardian, the mother's brother (*mamak*), would resent it as an affront. The law of female descent and its connected rules have as yet been mostly studied among the native Americans and Australians, where they have evidently undergone much modification. Thus, one hundred and fifty years ago, Father Lafitau mentions that the husband and wife, while in fact moving into one another's hut, or setting up a new one, still kept up the matriarchal idea by the fiction that neither he nor she quitted their own maternal house. But in the Sumatra district just referred to, the matriarchal system may still be seen in actual existence, in a most extreme and probably early form. If, led by such new evidence, we look at the map of the world from this point of view, there discloses itself a remarkable fact of social geography. It is seen that matriarchal exogamous society, that is, society with female descent and prohibition of marriage within the clan, does not crop up here and there, as if it were an isolated invention, but characterizes a whole vast region of the world. If the Malay district be taken as a center, the system of intermarrying mother-clans may be followed westward into Asia, among the Garos and other hill tribes of India. Eastward from the Indian Archipelago it pervades the Melanesian Islands, with remains in Polynesia; it prevails widely in Australia, and stretches north and south in the Americas. This immense district represents an area of lower culture, where matriarchalism has only in places yielded to the patriarchal system, which develops with the idea of property, and which, in the other and more civilized half of the

globe, has carried all before it, only showing in isolated spots and by relics of custom the former existence of matriarchal society. Such a geographical view of the matriarchal region makes intelligible facts which, while not thus seen together, were most puzzling. When years ago Sir George Grey studied the customs of the Australians, it seemed to him a singular coincidence that a man whose maternal family name was Kangaroo might not marry a woman of the same name, just as if he had been a Huron of the Bear or Turtle totem, prohibited accordingly from taking a wife of the same. But when we have the facts more completely before us, Australia and Canada are seen to be only the far ends of a world-district pervaded by these ideas, and the problem becomes such a one as naturalists are quite accustomed to. Though Montreal and Melbourne are far apart, it may be that in prehistoric times they were both connected with Asia by lines of social institution as real as those which in modern times connect them through Europe. Though it is only of late that this problem of ancient society has received the attention it deserves, it is but fair to mention how long ago its scientific study began in the part of the world where we are assembled. Father Lafitau, whose "Mœurs des Sauvages Amériquains" was published in 1724, carefully describes among the Iroquois and Hurons the system of kinship to which Morgan has since given the name of "classificatory," where the mother's sisters are reckoned as mothers, and so on. It is remarkable to find this acute Jesuit missionary already pointing out how the idea of the husband being an intruder in his wife's house bears on the pretense of surreptitiousness in marriage among the Spartans. He even rationally interprets in this way a custom which to us seems fantastic, but which is a most serious observance among rude tribes widely spread over the world. A usual form of this custom is that the husband and his parents-in-law, especially his mother-in-law, consider it shameful to speak to or look at one another, hiding themselves or getting out of the way, at least in pretense, if they meet. The comic absurdity of these scenes, such as Tanner describes among the Assiniboins, disappears if they are to be understood as a legal ceremony, implying that the husband has nothing to do with his wife's family. To this part of the world also belongs a word which has been more effective than any treatise in bringing the matriarchal system of society into notice. This is the term *totem*, introduced by Schoolcraft to describe the mother-clans of the Algonquins, named "Wolf," "Bear," etc. Unluckily the word is wrongly made. Professor Max Müller has lately called attention to the remark of the Canadian philologist, Father Cuoq ("N. O. Ancien Missionnaire"), that the word is properly *ote*, meaning "family mark," possessive *otem*, and with the personal pronoun *nind otem*, "my family mark," *kit otem*, "thy family mark." It may be seen, in Schoolcraft's own sketch of Algonquin grammar, how he erroneously made from these a word *totem*, and the question ought perhaps to be gone into in this

section, whether the term had best be kept up or amended, or a new term substituted. It is quite worth while to discuss the name, considering what an important question of anthropology is involved in the institution it expresses. In this region there were found Iroquois, Algonquins, Dakotas, separate in language, and yet whose social life was regulated by the matriarchal totem structure. May it not be inferred from such a state of things, that social institutions form a deeper-lying element in man than language or even physical race-type? This is a problem which presents itself for serious discussion, when the evidence can be brought more completely together.

It is obvious that, in this speculation, as in other problems now presenting themselves in anthropology, the question of the antiquity of man lies at the basis. Of late no great progress has been made toward fixing a scale of calculation of the human period, but the arguments as to time required for alterations in valley-levels, changes of fauna, evolution of races, languages, and culture, seem to converge more conclusively than ever toward a human period short indeed as a fraction of geological time, but long as compared with historical or chronological time. While, however, it is felt that length of time need not debar the anthropologists from hypotheses of development and migration, there is more caution as to assumptions of millions of years where no arithmetical basis exists, and less tendency to treat everything prehistoric as necessarily of extreme antiquity, such as, for instance, the Swiss lake-dwelling and the Central American temples. There are certain problems of American anthropology which are not the less interesting for involving no considerations of high antiquity; indeed, they have the advantage of being within the check of history, though not themselves belonging to it.

Humboldt's argument as to traces of Asiatic influence in Mexico is one of these. The four ages in the Aztec picture-writings, ending with catastrophes of the four elements, earth, fire, air, water, compared by him with the same scheme among the Banyans of Surat, is a strong piece of evidence which would become yet stronger if the Hindoo book could be found from which the account is declared to have been taken. Not less cogent is his comparison of the zodiacs or calendar-cycles of Mexico and Central America with those of Eastern Asia, such as that by which the Japanese reckon the sixty-year cycle by combining the elements *seriatim* with the twelve animals, Mouse, Bull, Tiger, Hare, etc.; the present year is, I suppose, the second water-ape year, and the time of day is the goat-hour. Humboldt's case may be re-enforced by the consideration of the magical employment of these zodiacs in the Old and New World. The description of a Mexican astrologer, sent for to make the arrangements for a marriage by comparing the zodiac animals of the birthdays of bride and bridegroom, might have been written almost exactly of the modern Calmucks; and in fact it seems connected in origin with similar rules in our own books of astrology.

Magic is of great value in thus tracing communication, direct or indirect, between distant nations. The power of lasting and traveling which it possesses may be instanced by the rock-pictures from the sacred Roches Percées of Manitoba, sketched by Dr. Dawson, and published in his father's volume on "Fossil Man," with the proper caution that the pictures, or some of them, may be modern. Besides the rude pictures of deer and Indians and their huts, one sees with surprise a pentagram more neatly drawn than that defective one which let Mephistopheles pass Faust's threshold, though it kept the demon in when he had got there. Whether the Indians of Manitoba learned the magic figure from the white man, or whether the white man did it himself in jest, it proves a line of intercourse stretching back twenty-five hundred years to the time when it was first drawn as a geometrical diagram of the school of Pythagoras. To return to Humboldt's argument, if there was communication from Asia to Mexico before the Spanish Conquest, it ought to have brought other things, and no things travel more easily than games. I noticed some years ago that the Aztecs are described by the old Spanish writers as playing a game called *patolli*, where they moved stones on the squares of a cross-shaped mat, according to the throws of beans marked on one side. The description minutely corresponds with the Hindoo game of *pachisi*, played in like manner with cowries instead of beans; this game, which is an early variety of backgammon, is well known in Asia, whence it seems to have found its way into America. From Mexico it passed into Sonora and Zacatecas, much broken down but retaining its name, and it may be traced still further into the game of plum-stones among the Iroquois and other tribes. Now, if the probability be granted that these various American notions came from Asia, their importation would not have to do with any remotely ancient connection between the two continents. The Hindoo element-catastrophes, the East Asiatic zodiac-calendars, the game of backgammon, seem none of them extremely old, and it may not be a thousand years since they reached America. These are cases in which we may reasonably suppose communication by seafarers, perhaps even in some of those junks which are brought across so often by the ocean-current and wrecked on the California coast. In connection with ideas borrowed from Asia there arises the question, How did the Mexicans and Peruvians become possessed of bronze? Seeing how imperfectly it had established itself, not even dispossessing the stone implements, I have long believed it to be an Asiatic importation of no great antiquity, and it is with great satisfaction that I find such an authority on prehistoric archæology as Professor Worsaae comparing the bronze implements in China and Japan with those of Mexico and Peru, and declaring emphatically his opinion that bronze was a modern novelty introduced into America. While these items of Asiatic culture in America are so localized as to agree best with the hypothesis of communication far south across the

Pacific, there are others which agree best with the routes far north. A remarkable piece of evidence pointed out by General Pitt-Rivers is the geographical distribution of the Tartar or composite bow, which in construction is unlike the long-bow, being made of several pieces spliced together, and which is bent backward to string it. This distinctly Asiatic form may be followed across the region of Behring Strait into America among the Esquimaux and northern Indians, so that it can hardly be doubted that its coming into America was by a northern line of migration. This important movement in culture may have taken place in remotely ancient times.

A brief account may now be given of the present state of information as to movements of civilization within the double continent of America. Conspicuous among these is what may be called the northward drift of civilization, which comes well into view in the evidence of botanists as to cultivated plants. Maize, though allied to, and probably genetically connected with, an Old World graminaceous family, is distinctly American, and is believed by De Candolle to have been brought into cultivation in Peru, whence it was carried from tribe to tribe up into the North. To see how closely the two continents are connected in civilization, one need only look at the distribution on both of maize, tobacco, and cacao. It is admitted as probable that from the Mexican and Central American region agriculture traveled northward, and became established among the native tribes. This direction may be clearly traced in a sketch of their agriculture, such as is given in Mr. Lucien Carr's paper on the "Mounds of the Mississippi Valley." The same staple cultivation passed on from place to place—maize, haricots, pumpkins, for food, and tobacco for luxury. Agriculture among the Indians of the Great Lakes is plainly seen to have been an imported craft by the way in which it had spread to some tribes but not to others. The distribution of the potter's art is similarly partial, some tribes making good earthen vessels, while others still boiled meat in its own skin with hot stones, so that it may well be supposed that the arts of growing corn and making the earthen pot to boil the hominy came together from the more civilized nations of the south. With this northward drift of civilization other facts harmonize. The researches of Buschmann, published by the Berlin Academy, show how Aztec words have become imbedded in the languages of Sonora, New Mexico, and up the western side of the continent, which could not have spread there without Mexican intercourse extending far northwest. This, indeed, has left many traces still discernible in the industrial and decorative arts of the Pueblo Indians. Along the courses of this northward drift of culture remain two remarkable series of structures probably connected with it. The *casas grandes*, the fortified communal barracks (if I may so call them) which provided house-room for hundreds of families, excited the astonishment of the early Spanish explorers, but are only beginning to be thoroughly described now that

such districts as the Taos Valley have come within reach by the railroads across to the Pacific. The accounts of these village-forts and their inhabitants, drawn up by Major J. W. Powell, of the Bureau of Ethnology, and Mr. Putnam, of the Peabody Museum, disclose the old communistic society surviving in modern times, in instructive comment on the philosophers who are seeking to return to it. It would be premature in the present state of information to decide whether Mr. J. L. Morgan, in his work on the "Houses and House-Life of the American Aborigines," has realized the conditions of the problem. It is plausible to suppose with him a connection between the communal dwellings of the American Indians, such as the Iroquois long-house with its many family hearths, with the more solid buildings inhabited on a similar social principle by tribes such as the Zuñis of New Mexico. Morgan was so much a man of genius, that his speculations, even when at variance with the general view of the facts, are always suggestive. This is the case with his attempt to account for the organization of the Aztec state as a highly developed Indian tribal community, and even to explain the many-roomed stone palaces, as they are called, of Central America, as being huge communal dwellings like those of the Pueblo Indians. I will not go further into the subject here, hoping that it may be debated in the section by those far better acquainted with the evidence. I need not, for the same reason, do much more than mention the mound-builders, nor enter largely on the literature which has grown up about them since the publication of the works of Squier and Davis. Now that the idea of their being a separate race of high antiquity has died out, and their earthworks, with the implements and ornaments found among them, are brought into comparison with those of other tribes of the country, they have settled into representatives of one of the most notable stages of the northward drift of culture among the indigenes of America.

Concluding this long survey, we come to the practical question how the stimulus of the present meeting may be used to promote anthropology in Canada. It is not as if the work were new here; indeed, some of its best evidence has been gathered on this ground from the days of the French missionaries of the seventeenth century. Naturally, in this part of the country, the rudimentary stages of thought then to be found among the Indians have mostly disappeared. For instance, in the native conceptions of souls and spirits the crudest animistic ideas were in full force. Dreams were looked on as real events, and the phantom of a living or a dead man seen in a dream was considered to be that man's personality and life, that is, his soul. Beyond this, by logical extension of the same train of thought, every animal or plant or object, inasmuch as its phantom could be seen away from its material body in dreams or visions, was held to have a soul. No one ever found this primitive conception in more perfect form than Father Lallemant, who describes, in the "Rélations des Jesuites"

(1626), how, when the Indians buried kettles and furs with the dead, the bodies of these things remained, but the souls of them went to the dead men who used them. So Father Le Jeune describes the souls, not only of men and animals, but of hatchets and kettles, crossing the water to the Great Village out in the sunset. The genuineness of this idea of object-souls is proved by other independent explorers finding them elsewhere in the world. Two of the accounts most closely tallying with the American come from the Rev. Dr. Mason, in Burmah, and the Rev. J. Williams, in Feejee. That is to say, the most characteristic development of early animism belongs to the same region as the most characteristic development of matriarchal society, extending from Southeast Asia into Melanesia and Polynesia, and North and South America. Every one who studies the history of human thought must see the value of such facts as these, and the importance of gathering them up among the rude tribes who preserve them, before they pass into a new stage of culture. All who have read Mr. Hale's studies on the Hiawatha legend and other Indian folk-lore must admit that the native traditions, with their fragments of real history, and their incidental touches of native religion, ought never to be left to die out unrecorded. In the Dominion, especially in its outlying districts toward the Arctic region and over the Rocky Mountains, there is an enormous mass of anthropological material of high value to be collected; but this collection must be done within the next generation, or there will be little left to collect. The small group of Canadian anthropologists, able and energetic as they are, can manage and control this work, but can not do it all themselves. What is wanted is a Canadian Anthropological Society with a stronger organization than yet exists, able to arrange explorations in promising districts, to circulate questions and requirements among the proper people in the proper places, and to lay a new burden on the shoulders of the already hard-worked professional men, and other educated settlers through the newly opened country, by making them investigators of local anthropology. The Canadian Government, which has well deserved the high reputation it holds throughout the world for wisdom and liberality in dealing with the native tribes, may reasonably be asked to support more thorough exploration, and collection and publication of the results, in friendly rivalry with the United States Government, which has in this way fully acknowledged the obligation of making the colonization of new lands not only promotive of national wealth, but serviceable to science. It is not for me to do more here, and now, than to suggest practical steps toward this end. My laying before the section so diffusive a sketch of the problems of anthropology, as they present themselves in the Dominion, has been with the underlying intention of calling public notice to the important scientific work now standing ready to Canadian hands; the undertaking of which, it is to be hoped, will be one outcome of this visit of the British Association to Montreal.

SCHOOL-CULTURE OF THE OBSERVING FACULTIES.*

By J. C. GLASHAW.

WHY should children be sent to school? Is it merely that they may learn to read, to write, and cipher? Reading, writing, and ciphering are no doubt very important, but are they all-important, or even most important? The man who reads may be said to hear from the past and the distant; the man who writes speaks to the future and the far away. Reading and writing are indeed important, for they enable us to converse untrammeled by the shackles of time and space. But the man who reads learns only what others already know, and he learns it, mayhap, not even as they know it, but only as they express their knowledge, and as he understands that expression. He looks at things through other men's spectacles, without knowing whether those spectacles magnify, minify, color, or distort. Surely more important than learning and blindly accepting the opinions of other men is it to be able to form opinions for one's self, and at the same time to know that these opinions have been properly arrived at and are correct.

If a boy is to be a carpenter, it is all very well for him to read about the different kinds of wood he will have to work upon, and about the various tools employed in his future trade, but he will learn to use these tools only by using them; he will learn to distinguish the different kinds of wood, and to select the kind and the piece suitable for his purpose in each case, only by actual practice of his trade. And what is true of the carpenter is true, *mutatis mutandis*, of every other handicraft, of every business, of every profession. However much one may learn by reading, it is but little and unimportant compared to what must be learned by actual practice. But even if we desired it we can not, during the short time our pupils are at school, exercise them in all the trades and professions. What, then, can we do? We can so teach them that this practice, when it must begin, will not be set about in a blind, hap-hazard way. We can and we ought to teach our pupils HOW TO LEARN; we can train them and we ought to train them to observe and to use the results of their observation.

But, the handicraft, the business, or the profession once learned, is the boy, now grown a man, done with observation? By no means. Every time he is called upon to make application of the knowledge he possesses, the skill he has acquired, he must observe, draw inferences, and reason therefrom; and his success in his calling will depend on the accuracy with which he does all this. Reading will supply him with other men's observations and reasonings, but these will be useless

* Read before the Ottawa Teachers' Association.

for the case in hand, unless they were made under like circumstances, or unless they can be modified to suit the present conditions. Now, to judge what are the real circumstances and conditions of the case, the man must be able to observe these conditions, and to distinguish those that are essential from those that are merely accidental, to interpret his observations aright, and then to reason correctly from the results thus obtained.

But man does not exist wholly and solely to carry on some handicraft, business, or profession. Around him lies a world abounding with endless sources of health and happiness, if only he knows where to look for them and how to use them, but equally abounding with pitfalls of misery and distress to all who grope through life intellectually blind and deaf, who having eyes see not, and having ears hear not. Now, the securing of that health and happiness of which I have spoken, so far as it depends on the material world around a man, will depend on his ability to observe closely, to systematize his observations into related groups, and to connect these with the observations and experiences of other men, so as to obtain therefrom a living knowledge of the laws of his being and of the world around him. Here, again, power of observation is the first and most important requisite, and, as a natural gift or talent, this power is extremely rare; "for the observer," as John Stuart Mill has remarked, "is not he who merely sees the thing which is before his eyes, but he who sees what parts that thing is composed of. One person, from inattention or from attending only in the wrong place, overlooks half of what he sees; another sets down much more than he sees, confounding it with what he imagines, or with what he infers; another takes note of the *kind* of all the circumstances, but, being inexpert in estimating their degree, leaves the quantity of each vague and uncertain; another sees indeed the whole, but makes such an awkward division of it into parts, throwing things into one mass which require to be separated, and separating others which might more conveniently be considered as one, that the result is much the same as, sometimes even worse than, if no analysis had been attempted at all."

But if man does not exist solely for his profession, neither does he exist solely for and unto himself. He is under certain obligations to his family and to his fellow-men, he has domestic and social duties, and to fulfill these aright, amid the ever-shifting conditions of life, requires the keenest powers of observation, of interpretation, and of judgment. And although destruction as surely awaits the man who dwells in moral darkness as it does him who takes his way heedless of all the physical laws of his being, too often the evil he does dies not with him, but lives and works woe to those he loved and would fain have protected. Yet it is here, it is in what regards their social life (and under social I include domestic and political), that too many men seem to be unable to observe aright or to make any use of such ob-

servations as they may have correctly made. When their course is not taken at utter random, too often it is guided by blind empiricism, or else is only a prolonged game of "follow your leader." The boy was not trained to observe and to think for himself when the subjects he had to examine and to think about were comparatively simple, and now the grown man will not or can not do it, or, if he does actually try, he is as likely to go astray as to go right, for he now must begin on what is extremely complex.

If, then, our school instruction aims at preparing pupils for the duties of after-life, however important we may deem those forms of hearing and speaking which we call reading and writing, even more important ought we to consider observation and inference and reasoning therefrom. That man is best equipped for the mental work which is more or less the business of every one from the cradle to the grave, who is able to use all his senses aright, who best knows all the precautions that must be taken to guard against misinterpreting the evidence of those senses, and against wrong reasoning from that evidence; who best knows how to trace thought backward to the grounds of belief and forward to discovery and verification. That is the best education that fosters the mother of freedom — independence of thought.

I have spoken of the insufficiency of reading and writing as a means of education, because there are still among us some who declare that these arts, with a little knowledge of ciphering, are all that should be taught in our public schools, are all the education that should be given to the children of the people; all the training for the battle of life, for the "struggle for existence," that should be provided for those who will have to bear the brunt of that battle, who will have to wage the fiercest contests in that strife. By all means, teach the children to read, teach them to write, teach them to cipher, but also train them in those mental processes which all men have to employ somehow or other every hour of their waking life, in every transaction of their daily business. Train them to do well and to know that they are doing well what they must do if they are to live at all.

But how is a child to be trained in these mental processes? In exactly the same way that he is trained in any art, in any handicraft. A man learns to play on the violin by playing on the violin, and no amount of directions without actual practice will make him proficient. So a child must be taught to observe by observing, to draw inferences by inferring, and to reason correctly by reasoning correctly; but if he is to do these things well he must practice them at first under the guidance of a master in these arts, and must have before him models of perfection in them. Now, Science presents us with the very best examples of accurate and discriminative observation, and of inference therefrom; it begins with the study of the very simplest phenomena, and advances its investigations step by step to a complete and exhaust-

ive analysis of the most complicated actions and relations. It is pre-eminently the study in which one is trained in the *whole* art of thinking, and in which one is taught to be conscious of each step he takes in the onward march of his investigations, and to know that the course he is following, and that course alone, will lead him to the truth, the arriving at which is the ultimate object of all his labors.

But here I must utter a word of warning. It is of the utmost importance to distinguish clearly between *scientific information* and *training in science*, between a mere literary acquaintance with scientific facts such as may be attained by a reader possessed of a somewhat acute mind and a fair share of constructive imagination and that power, those habits of mind, which are only to be gained by the study of facts at first hand. To the majority of pupils, it would not be the information they would gain by a study of science, valuable though this would be, that would be of chief importance, but the scientific habit of mind they would acquire. This habit would be of incalculable benefit to them whatever might be their avocations in after-life, and it would be better attained by a thorough investigation of the facts and principles of one science than by a general acquaintance with what has been spoken or written about many of them.

That this warning against confusing information and training is not wholly unnecessary will be seen by the following extract from the late Professor Todhunter's essay, entitled "The Conflict of Studies":

"We assert," says the professor, "that, if the resistance of the air be withdrawn, a sovereign and a feather will fall through equal spaces in equal times. Very great credit is due to the person who first imagined the well-known experiment to illustrate this, but it is not obvious what is the special benefit now gained by seeing a lecturer repeat the process. It may be said that a boy takes more interest in the matter by seeing for himself, or by performing for himself, that is, by working the handle of the air-pump; this we admit, while we continue to doubt the educational value of the transaction. The boy would also take much more interest in foot-ball than in Latin grammar, but the measure of his interest is not identical with that of the importance of the subjects. It may be said that the fact makes a stronger impression on the boy through the medium of his sight, that he believes it more confidently. I say that this ought not to be the case. If he does not believe the statement of his tutor—probably a clergyman of mature knowledge, recognized ability, and blameless character—his suspicion is irrational, and manifests a want of the power of appreciating evidence, a want fatal to his success in that branch of science which he is supposed to be cultivating."

Professor Todhunter was an eminent teacher of mathematics; he wrote many text-books on this science, some of which have been translated into nearly every civilized tongue, he even wrote an elementary text-book on physical science, the very science the boy is here as-

sumed to be studying, yet in the above paragraph he presents us with an argument which would be amusing had it come from the pen of a mere literary man, but which it is almost impossible to believe a cultivator of science could advance in sober earnest. What would have been the thoughts and feelings of the professor had one of his pupils, when asked to demonstrate the *pons asinorum*, returned answer:

"Sir, my tutor was the Rev. Mr. Jones, of Westbury; he is a clergyman of mature knowledge, recognized ability, and blameless character. Now, he assured me that he had examined Euclid's proof of this proposition, and had found it to be correct, and as to doubt his word would be to manifest irrational suspicion, and a want of power to properly appreciate evidence, I accepted his testimony, and I now offer it to you as my proof."

I suspect that that pupil's ideas of proof would have received a clearing up. He would have learned that there are other kinds of evidence besides oral testimony, and that it is as necessary to be able to judge of the validity in each case, of these other kinds of evidence, as it is to be able to judge of the value of testimony. He would learn that, unless he were to be a professed mathematician, a knowledge of the bare truth of the *pons asinorum* was a matter of no moment, the important thing was to see how that truth was arrived at, and how it was demonstrated; the educative factor present in the study was the exercise of the reasoning faculties, and of the powers of orderly arranging and of clearly presenting all the parts of a somewhat long argument.

So in the experiment with the sovereign and the feather, the mere testing of the truth or the falsehood of the statement that, if the resistance of the air be got rid of, a feather will fall earthward as fast as a sovereign, is not the chief thing aimed at. In fact, this statement should not be advanced prior to the performance of the experiment, but the fact stated in it should be discovered by the pupils for themselves from the experiment; and I beg to add that, had Professor Todhunter ever actually tried the experiment with the common apparatus, he would possibly have found the discovery of the fact not quite so simple a matter for a boy as he evidently imagined it to be.

But Professor Todhunter, while admitting that a boy takes more interest in seeing an experiment performed or in performing it for himself than in merely hearing a statement of its truth, doubts the educational value of the appeal to the senses. Any teacher of natural science worthy of the name of teacher would from his experience be able instantly to explain why this increase of interest, and instantly to set all doubts regarding the matter to rest. *There seems in many minds to be an almost total separation between words and the things they represent, except as regards constantly recurring incidents of their daily life.* Hence words seem to have no power in such cases to call

up and keep before the mental vision a distinct image of the thing reasoned about. In fact, what is called the scientific imagination seems almost wanting in many minds until a severe course of training in science arouses the dormant faculty, and develops into the actual and the active what otherwise would have remained an unnoticed and neglected potentiality. The consequence is, that the teacher who depends on verbal statements alone can never be sure that the ideas so clear to himself are correct, if at all apprehended by his pupils, and that these are not increasing their ignorance rather than their knowledge. Many minds which seem to become sluggish, or to wither away when fed with what to them are the dry husks of words, are roused to activity and intelligence when they are directed to the study of things and the relations of things, when they are brought face to face, so to speak, with the actual phenomena of the world around and within them.

But before I pass from this let me point out that the guinea-and-feather experiment, if *successfully* performed, is about as bad an example of an educative experiment as could well be selected. The bare fact to be observed would stand out too distinctly, too completely disentangled from other phenomena to give it any value in training the observing faculties of any but mere infants, while the inferences and deductions from the results of the experiment are too abstruse for any but those who have advanced some way in quantitative analysis of phenomena. Moreover, the mere experimental result can be obtained without any elaborate apparatus, while the deduced propositions can be, and in actual practice generally are, arrived at by simpler means. In truth, the experiment is not one which should be presented to the pupil in order to deduce from it that the earth's attraction depends, not on the nature of a body, but merely on its mass, but he should be skillfully led to suggest this experiment as a test of the truth of this proposition. In fact, it is an experiment of *verification*, not an experiment of *discovery*.

It was my intention, when I consented to address you on this subject, to present you with an outline of how actually to proceed in order to give children a systematic training in observation, selecting plants as the objects for examination. Botany has been called a science of mere names, and it must be confessed it has too often been presented as such ; but, rightly treated, it offers a wide field and ample scope for observation of the forms, the positions, and the functions of the various parts of plants, of the relations of these parts to each other, and of their modifications and adaptations to varying conditions, as well as for many other observations just such as children in our primary classes are capable of making. But all, and more than all, I purposed doing, has been done and so well done by Miss Eliza A. Youmans, in her "First Book of Botany," that I believe it will be better to refer you direct to that work, rather than to enter on details here. If one

of you will take, say, a second class through the first twenty exercises in Miss Youmans's little book, working them out conscientiously and thoroughly, I do not hesitate to predict that that class will by this means acquire more real knowledge and more intellectual power than it would acquire from all the reading, writing, and ciphering done in the first four classes, if done without such a course. Furthermore, the power gained and the habits acquired in the study of plants, or even in the examination of leaves, will not be confined solely to these, but will be directed to and exercised upon all other objects coming within the range of the children's observation; thus their general knowledge will be extended, and, as a result, your pupils will read with more intelligence and with fuller comprehension of what they are reading about. As for arithmetic—and here I can speak with some authority—you will find that you have somehow bridged over the to many seemingly impassable gulf between the mere art of ciphering and the application of that art to the resolution of numerical problems. Words will no longer be mere vacant forms or empty sounds, their content will be restored to them, the data of the problem will be mentally *realized*, and their interrelations discovered and comprehended. In nine cases out of ten, it is the inability to realize the data, to project before the mind's eye a picture of the reality, that is the actual stumbling-block in the way of children who fail in the solution of arithmetical problems.

But the work had better not be done at all if it be not done *thoroughly* and *conscientiously*. All that can be done in a text-book is merely to set up numerous finger-posts to guide the student or the teacher; the scenery on the route can not be presented in all its fullness of detail, with all its play of light and shade; to behold it one must actually travel the road. In the course of teaching these twenty exercises, thousands of questions will arise of whys and wherefores, some of which you will have to put aside for the time being at least; but to others you must lead your children to find the answers for themselves. All these questions can not possibly be anticipated in any book; and it is well they can not be so, for, ever new, ever changing, they afford mental exercise to the teacher as well as to the pupils, and thus prevent any danger of stagnation on either side. Let me take in illustration a very simple question; one interesting to myself personally, because it was the first botanical problem I ever solved, but which, if the solution be properly generalized, is interesting in itself as giving the key to many peculiarities in the forms and markings of leaves.

When I was but a lad at school, a fellow-pupil, the son of a farmer, told me that on the back of every green blade of oats there was legibly stamped a capital B. I laughed at him for his simplicity in thinking he could make me believe such an "old wife's fable"; but he indignantly replied that not only had his father told him of

the strange marking, but he had looked and seen it for himself. The only way, it seemed to me, to treat such an argument as this was, to change the subject of conversation, and this I did, a slight smile of incredulity letting my playmate know that he had not wholly imposed upon me. That very afternoon I happened to pass a field of oats, and, remembering the assertion of the mysterious markings, I determined to put the question of their reality to the proof of observation at once, and for altogether. I must confess, however, it was only after a mental struggle that I brought myself to cross the fence into the field; for the assertion seemed to me utterly absurd, and I had not then learned that, rightly taken, there is no such thing as "being made a fool of." But what were my amazement and confusion to find, on the very first leaf I examined, a capital B as clearly marked as if it had been impressed with a die! Quickly gathering and examining other leaves, I found on all of them a marking, in some a mere blur, on others clear and distinct as I had found it on the first leaf. Straightway occurred the questions: What really is this mark? What causes it? I stood among the growing oats, so the answer was neither far to seek nor difficult to find; but I have never forgotten it, for no teacher told it to me—I found it out for myself. I rediscovered the solution of the mystery of this leaf-signature, and, although it must have been discovered and rediscovered thousands of times before, yet I enjoyed all the deep delight of discovery—a delight which never cloys, a pleasure which never palls. What is more, I soon found that my eyes had, as it were, been opened; I found that I could see many other strange things about leaves which, till then, had escaped my notice, and I found that I possessed the key to their solution.

But, if I urge on you the teaching of natural science, I also recognize the difficulties you will encounter if you accept my advice. You will have to teach from the actual objects, a method utterly and radically different from the text-book instruction to which you are accustomed. You will for a time have to submit to the adverse criticisms of those parents who judge of a child's progress, not by its mental growth, but merely by its increase of skill in the art of recognizing the marks that represent certain sounds, and of repeating those sounds, an art too often confused with reading. You will, some of you, have to struggle with classes not too large to inform by telling but far too large to educate by training. But overcome the first difficulty, overcome yourselves, and you will find the others will lessen day by day, and will soon disappear altogether, the little remaining of them being lost sight of in the increase of brightness which the new study will bring to the life of the school-room.

QUEER FLOWERS.

By GRANT ALLEN.

IF Baron Munchausen had ever in the course of his travels come across a single flower one standard British yard in diameter, fifteen pounds avoirdupois in weight, and forming a cup big enough to hold six quarts of water in its central hollow, it is not improbable that the learned baron's veracious account of the new plant might have been met with the same polite incredulity which his other adventures shared with those of Bruce, Stanley, Mendez Pinto, and Du Chaillu. Nevertheless, a big blossom of this enormous size has been well known to botanists ever since the beginning of the present century. When Sir Stamford Raffles was taking care of Sumatra during our temporary annexation, he happened one day to light upon a gigantic parasite, which grew on the stem of a prostrate creeper in the densest part of the tropical jungle. It measured nine feet round and three feet across; it had five large, fleshy petals with a central basin; and it was mottled red in hue, being, in fact, in color and texture surprisingly suggestive of raw beefsteak. One flower was open when Sir Stamford came upon it; the other was in the bud, and looked in that state extremely like a very big red cabbage. Specimens of this surprising find were at once forwarded to England (how, history does not inform us); and, after the place of the plant in the classificatory system had been strenuously fought out with the usual scientific amenities, it was at last duly labeled (through no fault of its own), after the names of its two discoverers, as *Rafflesia Arnoldi.*

The mere size of this mammoth among flowers would in itself naturally suffice to give it a distinct claim to respectful attention; but Rafflesia possesses many other sterling qualities far more calculated than simple bigness to endear it to a large and varied circle of insect acquaintances. The oddest thing about it, indeed, is the fact that it is a deliberately deceptive and alluring blossom. As soon as it was first discovered, Dr. Arnold noticed that it possessed a very curious carrion-smell, exactly like that of putrefying meat. He also observed that this smell attracted flies in large numbers by false pretenses to settle in the center of the cup. But it is only of late years that the real significance and connection of these curious facts have come to be perceived. We now know that Rafflesia is a flower which wickedly and feloniously lays itself out to deceive the confiding meat-flies and to starve their helpless infants in the midst of apparent plenty. The majority of legitimate flowers (if I may be allowed the expression) get themselves decently fertilized by bees and butterflies, who may be considered as representing the regular trade, and who carry the fecundating pollen on their heads and proboscises from one blossom to an-

other, while engaged in their usual business of gathering honey all the day from every opening flower. But Rafflesia, on the contrary, has positively acquired a fallacious external resemblance to raw meat, and a decidedly high flavor, on purpose to take in the too trustful Sumatran flies. When a fly sights and scents one, he (or rather she) proceeds at once to settle in the cup, and there lay a number of eggs in what it naturally regards as a very fine decaying carcass. Then, having dusted itself over in the process with plenty of pollen from this first flower, it flies away confidingly to the next promising bud, in search both of food for itself and of a fitting nursery for its future little ones. In doing so, it of course fertilizes all the blossoms that it visits, one after another, by dusting them successively with one another's pollen. When the young grubs are hatched out, however, they discover the base deception all too late, and perish miserably in their fallacious bed, the helpless victims of misplaced parental confidence. Even as Zeuxis deceived the very birds with his painted grapes, so Rafflesia deceives the flies themselves by its ingenious mimicry of a putrid beefsteak. In the fierce competition of tropical life, it has found out by simple experience that dishonesty is the best policy.

The general principle which this strange flower illustrates in so striking a fashion is just this: Most common flowers have laid themselves out to attract bees, and so a bee-flower forms our human ideal of a central typical blossom: it looks, in short, we think, as a flower ought to look. But there are some originally minded and eccentric plants which have struck out a line for themselves, and taken to attracting sundry casual flies, wasps, midges, beetles, snails, or even birds, which take the place of bees as their regular fertilizers; and it is these Bohemians of the vegetable world that make up what we all consider as the queerest and most singular of all flowers. They adapt their appearance and structure to the particular tastes and habits of their chosen guests.

Now, the fact is, we are all a little tired of that prig and Aristides among insects, the little busy bee. We have heard his virtues praised by poets, moralists, and men of science, till we are all burning to ostracize him forthwith, for the sake of never more hearing him called industrious and intelligent. He and his self-righteous cousin, the ant, are in fact a pair of egregious Pharisaical humbugs, who have made a virtue of their own excessive acquisitiveness, and have induced Solomon, Virgil, Dr. Watts, and other misguided human beings to acquiesce far too readily in their preposterous claims. For my own part, I never was more pleased in my life than when Sir John Lubbock conclusively proved by experiment that they were both extremely stupid and uninventive insects, with scarcely a faint glimmering of brotherly love or any other good ethical quality. I propose, therefore, in this present paper, to leave the too-much-belauded bee, with the flowers that cater for his tastes, entirely out of consideration, and look only

at some of the peculiar blossoms which appeal rather to the senses and sensibilities of other and more original insect guests.

The wasp, though undoubtedly an irascible and ill-balanced creature, and a *chauvinist* of the fiercest description, is yet a person of far more width of mind and far wider range of experience in his own way than the *borné* and conventional bee. His taste, in fact (like the taste of that hypothetical person, the general reader), is quite omnivorous: while he does not refuse meat, he has an excellent judgment in the sunny side of peaches, and he can make a meal at a pinch off the honey in more than one kind of wasp-specialized flower. But the peculiar likes and dislikes of wasps have produced a curious effect upon the shape and hue of the blossoms which owe their traits to these greedy and not very æsthetic insects. Your bee has a long proboscis and a keen sense of color; so the flowers that lay themselves out on his behalf store their honey at the end of a long tube, and rejoice in brilliant blue or crimson or purple petals. Your wasp, on the other hand, in his matter-of-fact Philistine fashion, cares for none of these things: he asks only plenty of honey, and no foolish obstructions in the way of getting it. Accordingly, wasp-flowers are remarkable for having a helmet-shaped tube, exactly fitted to a wasp's head, with abundant honey filling the bottom of the bell, while in color they are generally a peculiar livid reddish brown, more or less suggestive of a butcher's shop.

We have two or three good typical wasp-flowers, wild or cultivated, in England, of which the snowberry of our shrubberies is probably the best known to the outside public, other than wasps. But the dingy fig-worts that grow by the water-side are far more noteworthy, because they have such extremely odd-looking, one-sided blossoms, made to measure by nature for the wasp's head. The minuteness with which plants adapt themselves to the merest tricks of habit in the insects to whom they are habitually at home is very well illustrated in this queer plant. Bees and butterflies, and all other regular flower-haunters, have a trick of beginning at the bottom of a spike of flowers (as in foxglove or sage), and working gradually upward; so in these cases the pollen-bags ripen first, while the sensitive surface of the seed-vessel doesn't mature till a later period. Thus, the bee, lighting first on the older and lower flowers, in their second stage, fertilizes them with the pollen he has brought from the last plant; while on the upper part of the spike he gathers more pollen, which he carries away to the next plant, and so insures the great desideratum of nature, a healthy cross. But the wasp, with his usual perversity of disposition, reverses all this: *he* begins at the top of the spike, and works gradually downward. To meet this abnormal fancy of the vespine intellect, the fig-wort makes its sensitive surface mature first, while its pollen-bags only shed their mealy dust a little later. So the wasp, lighting first on the newly opened blossoms at the top, comes in

contact with the ripe summit of the seed-vessel, on which he rubs the pollen from the last spike he visited; and then, proceeding downward, he unconsciously collects a fresh lot to carry away to the next fig-wort. Of course, the wasp himself is not in the least interested in these domestic arrangements of the plant whose honey he seeks; all he wants is his dinner, but in getting it he is compelled, without at all suspecting it, to act as carrier for the fig-wort from one spike to another.

Wasps are remarkably sharp and wide-awake insects; and it would be very difficult indeed to take them in. Flowers that bid for their attentions must provide real honey, and plenty of it. It is quite otherwise, however, with flies. Those mixed feeders are the stupidest and most gullible of all insects; and many unprincipled blossoms have governed themselves accordingly, and deliberately laid themselves out to deceive the poor foolish creatures by false appearances. On most mountain bogs in Britain one can still find a few pretty white flowers of the rare and curious Grass of Parnassus. They have each five snowy petals, and at the base of every petal stands a little forked organ, with eight or nine thread-like points, terminated, apparently, by a small round drop of pellucid honey. Touch one of the drops with your finger, and, lo! you will find it is a solid ball or gland. The flower, in fact, is only playing at producing honey. Yet so easily are the flies for whom it caters taken in by a showy advertisement, that not only will they light on the blossoms and try most industriously for a long time together to extract a little honey from the dry bulbs, but even after they have been compelled to give up the attempt as vain they will light again upon a second flower, and go through the whole performance again, *da capo*. The Grass of Parnassus thus generally manages to get its flowers fertilized with no expenditure of honey at all on its own part. Still, it is not a wholly and hopelessly abandoned flower, like some others, for it does really secrete a little genuine honey quite away from the sham drops, though to an extent entirely incommensurate with the pretended display.

Most of the flowers specially affected by carrion-flies have a lurid red color, and a distinct smell of bad meat. Few of them, however, are quite so cruel in their habits as Rafflesia. For the most part, they attract the insects by their appearance and odor, but reward their services with a little honey and other allurements. This is the case with the curious English fly-orchid, whose dull purple lip is covered with tiny drops of nectar, licked off by the fertilizing flies. The very malodorous carrion-flowers (or *Stapelias*) are visited by blue-bottles and flesh-flies, while an allied form actually sets a trap for the fly's proboscis, which catches the insect by its hairs, and compels him to give a sharp pull in order to free himself: this pull dislodges the pollen, and so secures the desired cross-fertilization. The Alpine butterwort sets a somewhat similar gin so vigorously that when a weak fly is caught

in it he can not disengage himself, and there perishes wretchedly, like a hawk in a keeper's trap.

These cases lead on naturally to certain other very queer flowers which similarly take advantage of the stupidity of flies by actually imprisoning them (without writ of *habeas corpus*) in a strong inner chamber, until they have duly performed the penal servitude of fertilization enjoined upon them by the inexorable blossom. The South European birthwort, a very lurid-looking and fly-enticing flower, has a sort of cornucopia-shaped tube, lined with long hairs, which all point inward, and so allow small midges to creep down readily enough, after the fashion of an eel-buck or lobster-pot. *Sed revocare gradum, superasque evadere ad auras*—to get out again is the great difficulty. Try as they will, the little prisoners can't crawl back upward against the downward-pointing hairs. Accordingly, they are forced, by circumstances over which they have no control, to walk aimlessly up and down their prison-yard, fertilizing the little knobby surface of the seed-vessel with pollen brought from another flower. But, as soon as the seeds are all impregnated, the stamens begin to shed their pollen, and dust over the gnats with the copious powder. Then the hairs all wither up, and the gnats, released from their lobster-pot prison, fly away once more on the same fool's errand. Before doing so, however, they make a good meal off the pollen that covers the floor, though they still carry away a great many grains on their own wings and bodies. One might imagine that, after a single experience of the sort, the midges would have sense enough to avoid birthwort in future; but your midge has really no more intelligence than your human drunkard, or gambler, or opium-eater. He flies straight off to the very next birthwort he sees, conveys to it the pollen from the last trap he visited, and gets confined once more in the inner chamber, till the plant is prepared to let him out again on ticket-of leave of short duration. Thus, like an habitual criminal, he spends almost all his time in getting from one jail into another. His confinement, however, is not solitary, but is mitigated by congenial intercourse with the ladies and gentlemen of his own kind.

A very similar but much larger fly-cage is set by our own common wild arum, or cuckoo-pint. This familiar big spring flower exhales a disagreeable, fleshy odor, which, by its meat-like flavor, attracts a tiny midge with beautiful iridescent wings and a very poetical name, *Psychoda*. As in most other cases where flies are specially invited, the color of the cuckoo-pint is usually a dull and somewhat livid purple. A palisade of hairs closes the neck of the funnel-shaped blossom, and repeats the lobster-pot tactics of the entirely unconnected South European birthwort. The little flies, entering by this narrow and stockaded door, fertilize the future red berries with pollen brought from their last prison, and are then rewarded for their pains by a tiny drop of honey, which slowly oozes from the middle of each embryo

fruitlet as soon as it is duly impregnated. Afterward, the pollen is shed upon their backs by the bursting of the pollen-bags; the hairs wither up, and open the previously barricaded exit, and the midges issue forth in search of a new prison and a second drop of honey. This is all strange enough; but stranger still, I strongly suspect the arum of deliberately hocusing its nectar. I have often seen dozens of these tiny flies rolling together in an advanced stage of apparent intoxication upon the pollen-covered floor of an arum-chamber; and the evidences of drunkenness are so clear and numerous that I incline to believe the plant actually makes them drunk in order to insure their staggering about in the pollen and carrying a good supply of it to the next blossom visited. It is a curious fact that these two totally unrelated plants (birthwort and arum) should have hit upon the very same device to attract insects of the same class (though not the same species). The trap must have been independently developed in the two cases, and could only have succeeded with such very stupid, unintelligent creatures as the flies and midges.

From plants that imprison insects to plants that devour insects alive is a natural transition. The giant who keeps a dungeon is first-cousin to the ogre who swallows down his captives entire. And yet the subject is really too serious a one for jesting; there is something too awful and appalling in this contest of the unconscious and insentient with the living and feeling, of a lower vegetative form of life with a higher animated form, that it always make me shudder slightly to think of it. Do you remember Victor Hugo's terrible description (I think it is in "Quatre-Vingt-Treize") of the duel between the great gun that has got loose from its chains on a ship in a storm, and the men who try to recapture it? Do you remember how the gun lunges, and tilts, and evades, and charges, exactly as if it were a living, sentient creature; and yet all the while the full horror of the thing depends upon the very fact that it is nothing more than a piece of lifeless, senseless metal, driven about on its wheels irresponsibly by the fury of the storm? Well, that description is awful and horrible enough; but it yet lacks one element of awesomeness which is present in the insect-eating plants, and that is the clear evidence of deliberate design and adaptation. When a crumbling cliff falls and crushes to death the creatures on the beach beneath it, we see in their fate only the accidental working of the fixed and unintentional laws of nature; but when a plant is so constructed, with minute cunning and deceptive imitativeness, that it continually and of malice prepense lures on the living insect, generation after generation, to a lingering death in its unconscious arms, there seems to be a sort of fiendish impersonal cruelty about its action which sadly militates against all our pretty platitudes about the beauty and perfection of living beings. It is quite a relief that we are able nowadays to shelve off the responsibility upon a dead materialistic law like natural selection or survival of the fittest. Hartmann's "Uncon-

scious" stands modern naturalists in good stead *vice* the personal interference of the mediæval or Miltonic devil, absent on leave.

On most English peaty patches there grows a little reddish-leaved, odd-looking plant, known as sun-dew. It is but an inconspicuous, small weed, and yet literary and scientific honors have been heaped upon its head to an extent almost unknown in the case of any other member of the British floral commonwealth. Mr. Swinburne has addressed an ode to it, and Mr. Darwin has written a learned book about it. Its portrait has been sketched by innumerable artists, and its biography narrated by innumerable authors. And all this attention has been showered upon it, not because it is beautiful, or good, or modest, or retiring, but simply and solely because it is atrociously and deliberately wicked. Like the late Mr. Peace and the heroes of the Newgate Calendar, it owes its vogue entirely to its murderous propensities. Sun-dew, in fact, is the best known and most easily accessible of the carnivorous and insectivorous plants.

The leaf of the sun-dew is round and flat, and is covered by a number of small red glands, which act as the attractive advertisement to the misguided midges. Their knobby ends are covered with a glutinous secretion, which glistens like honey in the sunlight, and so gains for the plant its common English name. But the moment a hapless fly, attracted by hopes of meat or nectar, settles quietly in its midst, on hospitable thoughts intent, the viscid liquid holds him tight immediately, and clogs his legs and wings, so that he is snared exactly as a peregrine is snared with bird-lime. Then the leaf with all its "red-lipped mouths" (I will own up that the expression is Mr. Swinburne's, *ubi supra*) closes over him slowly but surely, and crushes him by folding its edges inward gradually toward the center. The fly often lingers long with ineffectual struggles, while the cruel crawling leaf pours forth a digestive fluid—a vegetable gastric juice, as it were—and dissolves him alive piecemeal in its hundred clutching suckers. I have seen this mute tragedy enacted a thousand times over on the bogs and moorlands; and, though I often try to release the fresh flies from their ghastly living but inanimate prison, it is impossible to go round all the plants on a whole common, like a philodipterous Howard, ameliorating the condition of all the victims of misplaced confidence in the good intentions of the treacherous sun-dew.

Our little English insectivorous plants, however (we have at least five or six such species in our own islands), are mere clumsy bunglers compared to the great and highly developed insect-eaters of the tropics, which stand to them in somewhat the same relation as the Bengal tiger stands to the British wild-cat or the skulking weasel. The Indian pitcher-plants or Nepenthes bear big pitchers of very classical shapes (it is well known that Greek art has largely affected India), closed in the early state with a lid, which lifts itself and opens the pitcher as soon as the plant has fully completed its insecticidal arrange-

ments. In some kinds the pitcher ludicrously resembles a hot-water jug of modern British manufacture. The details of the trap vary somewhat in the different species, but as a whole the *modus operandi* of the plant is somewhat after this atrocious fashion: The pitcher contains a quantity of liquid, that of the sort appropriately known as the Rajah holding as much as a quart; and the insect, attracted in most cases by some bright color, crawls down the sticky side, quaffs the unkind Nepenthe, and forgets his troubles forthwith in the vat of oblivion prepared for him beneath by the delusive vases. A slimy Lethe flows over his dissolving corse, and the relentless pitcher-plant sucks his juices to supply his own fibers with the necessary nitrogenous materials.

The Californian pitcher-plant, or Darlingtonia, is a member of a totally distinct family, which has independently hit upon the same device in the Western world as the Indian Nepenthes in the Eastern hemisphere. The pitcher in this case, though differently produced, is hooded and lidded like its Oriental analogue; but the inside of the hood is furnished with short hairs, all pointing inward, and legibly inscribed (to the botanical eye) with the appropriate motto, "*Vestigia nulla retrorsum.*" The whole arrangement is colored dingy orange, so as to attract the attention of flies, and it contains a viscid digestive fluid in which the flies are first drowned and then slowly melted and assimilated. The pitchers are often found half full of dead and decaying assorted insects. This circumstance, of course, has not escaped the sharp eyes of the practically minded Californians, who accordingly keep the pitchers growing in their houses, to act as fly-catchers. Such an ingenious utilization of nature, in unconscious competition with the *papier moule*, would surely have occurred only to the two great Pacific civilizations of the Californian and the heathen Chinee.

There are a great many more of these highly developed insect-eaters, such as the Guiana heliamphora (more classical shapes), the Australian cephalotus, and the American side-saddle flowers, and they all without exception grow in very wet and boggy places, like our own sun-dews, butterworts, and bladderworts. The reason why so many marsh-plants have taken to these strange insect-eating habits is simply that their roots are often very badly supplied with manure or with ammonia in any form; and, as no plant can get on without these necessaries of life (in the strictest sense), only those marshy weeds have any chance of surviving which can make up in one way or another for the native deficiencies of their situation. The sun-dews show us, as it were, the first stage in the acquisition of these murderous habits; the pitcher-plants are the abandoned ruffians which have survived among all their competitors in virtue of their exceptional ruthlessness and deceptive coloration. I ought to add that in all cases the pitchers are not flowers, but highly modified and altered leaves, though in many

instances they are quite as beautifully colored as the largest and handsomest exotic orchids.

The principle of Venus's fly-trap is somewhat different, though its practice is equally nefarious. This curious marsh-plant, instead of setting hocused bowls of liquid for its victims, like a Florentine of the fourteenth century, lays a regular gin or snare for them, on the same plan as a common snapping rat-trap. The end of the leaf is divided into two folding halves by the midrib, and on each half are three or five highly sensitive hairs. The moment one of these hairs is touched by a fly, the two halves come together, inclosing the luckless insect between them. As if on purpose to complete the resemblance to a rat-trap, too, the edges of the leaf are formed of prickly, jagged teeth, which fit in between one another when the gin shuts, and so effectually cut off the insect's retreat. The plant then sucks up the juices of the fly, and, as soon as it has fully digested them, the leaf opens automatically once more, and resets the trap for another victim. It is an interesting fact that this remarkable insectivore appears to be still a new and struggling species, or else an old type on the very point of extinction, for it is only found in a few bogs over a very small area in the neighborhood of Wilmington, Southern California.

Strongly contrasting with the æstheticism of the artistically minded bees, who go in chiefly for peacock blues and Tyrian purples, as well as with the frank Philistinism of the carrion-flies, who like good, solid, meaty-looking red and brown flowers, is the ingenious secretiveness of the ichneumon-flies, who chiefly patronize invisible green blossoms, indistinguishable to a casual observer among the thick foliage in whose midst they grow. Most insects are very casual observers: they require a good sensible flaring patch of yellow or scarlet (like the posters of a country circus) to attract their giddy attention. But the ichneumons are sharp-eyed and highly discerning creatures, which have developed a whole set of pale-green flowers, so inconspicuous as to escape the notice of color-loving bees and butterflies, yet with a good supply of easily accessible honey to reward their cunning visitors. This honey the monopolist ichneumons of course keep strictly for their own use. That large and very odd-looking English orchid, the tway-blade, extremely common in woods and shady places, though seldom observed by the general public on account of its uniform greenness, is an excellent example of these ichneumon-made blossoms. The whole spike stands a foot and a half high, with numerous separate green flowers, each about half an inch long, yet it is very little noticed save by regular plant-hunters, because its color makes it all but indistinguishable among the tall grasses and sedges with whose blades it is closely intermingled. Yet, if it were only pink or purple, like most of the other English orchids, it would certainly rank as one of the largest and handsomest among our native wild-flowers.

In a few cases, the relation between the plant and the insect that

habitually fertilizes it is even closer and more lasting than in any of the instances we have yet considered. Everybody knows those large and handsome tropical lilies, the yuccas, with their tall, clustered heads of big white blossoms. Well, Professor Riley, the great American entomologist, has shown that the yuccas are entirely run (to use a favorite expression of his countrymen) by a comparatively small and inconspicuous moth, solely for its own benefit: and so completely is this the case, that the yucca can't manage to exist at all without its little winged intermediary. Professor Riley has, therefore, playfully named the little insect *Pronuba yuccasella;* freely translated, the yucca's bridesmaid. The moth bores the young capsule of the flower in several places, lays an egg in each hole, and then carefully collects pollen, with which it fertilizes the blossom, of set purpose, thus deliberately producing a store of food for its own future larvæ. The eggs hatch inside the capsule, and the young grubs eat part of the seeds, at the same time prudently leaving enough for the continuation of the yucca family in the future. As soon as the grubs are full-grown, they bore a hole again through the capsule, lower themselves by a thread to the ground, and there spin a cocoon which lies buried in the earth all through the autumn and winter. But in the succeeding summer, just fourteen days before the yuccas begin to flower, the grubs in their cocoons pass into the chrysalis stage; and, by the time the yuccas are in full blossom, they issue forth as perfect moths, and once more commence the fertilization of their chosen food-plant, and the laying of their own eggs. So singular an instance of mutual accommodation between flower and insect is rare indeed in this usually greedy and self-regarding world.

The extremely odd, inside-out, topsy-turvy flowers of the fig owe their fertilization, however, to a still more extraordinary and complicated cross-relationship. Hardly anybody (except a botanist) has ever seen a fig-flower, because it grows inside the stalk, instead of outside, and so can only be observed by cutting it open lengthwise. The fig, in its early youth, in fact, consists of a hollow branch on whose inner surface a number of very small flowers cluster together; and, when they are ripe for fertilization, the eye or hole at the top opens to admit the insect visitor. This visitor is the fig-wasp, who comes, not from other cultivated fig-trees, but from a wild tree called the caprifico. On this tree the mother wasps first lay their eggs in the inedible figs, which thereupon swell out into galls, and become the nurses of the young wasp-grubs. When the wasps are mature, they eat their way out of the wild fig where they were born, and set forth to lay their own eggs in turn, either on a brother caprifico or on its sister, a true fig-tree. Those wasps which enter the wild figs of a caprifico succeed in carrying out their maternal purpose, and lay their eggs on the right spot for more grubs to be duly developed. But those which happen to go into a true fig merely fertilize the flowers without laying

their eggs, because the figs are here so constituted that there is no proper place for them to lay on. In other words, the true fig is a cultivated wasp-proof caprifico. But, as the figs won't properly swell without fertilization, it becomes important to conciliate the attentions of the wasps; and for this reason the Italian peasants hang small branches of the caprifico on the boughs of the cultivated fig-trees, at the moment when the eye of the fig opens, and so shows that they are ready to be fertilized. The wasps, as they emerge from their own homes, enter the figs at once, and there set the little hard seeds, on whose impregnation the pulpy part of the fig begins to swell. The fruit of the caprifico itself never comes to anything, as it hardens and withers on the tree; but, since the true figs are dependent upon it for pollen, it follows that, if the caprificos were ever to become extinct, the supply of best Eleme in layers would forthwith cease entirely.—*Cornhill Magazine.*

ALCOHOLIC TRANCE.

By T. D. CROTHERS, M. D.

I PROPOSE to describe in a general way a peculiar mental state following the toxic use of alcohol, which has only recently attracted attention, and which promises to be a very imporant factor in the medical jurisprudence of the future. Morbid states of the nervous system, in which the mind seems to act automatically, and without consciousness of the surroundings, and with no registration by the memory of these acts, are not new to students of mental and nervous diseases; but the fact that they are more or less common in inebriety from alcohol, and may follow any excess, is a recent discovery. In 1879 I published a short paper "On Trance and Loss of Consciousness following Inebriety," which, as far as I can ascertain, was the earliest study of these cases ever made. The following are among the first cases which attracted my attention to this subject. In 1877 a patient was admitted to the asylum at Binghamton, with this incident in his history: A year before, while apparently sober, he purchased a trotting-horse, paying a fabulous price. Two days after, he denied all knowledge of the transaction, and became involved in a lawsuit. On the trial it appeared that the purchase of the horse had been discussed for many hours, and that the buyer had exhibited great sagacity and judgment to avoid deception; also that, although drinking large quantities of spirits, he gave no evidence of other than good judgment, and perfect knowledge of his acts and their consequences. In the defense it was shown that the purchase of the horse was a most unusual act; that he never showed any interest in fast horses, or racing, nor had he been on the race-course, and was in fact afraid of driving fast horses; and,

lastly, he had many horses in his stables, and needed the money paid for this horse, for a distinct purpose, which had been determined on before. From his own testimony he had many blanks of memory while drinking, and at this time had lost all recollection of passing events from the hour of dinner, during which he drank freely, until next morning, when he drank again and fell into another blank which lasted thirty-six hours. Other testimony indicated a gradual increasing dullness and abstractedness of manner during this time ; also apparent disinclination to fix his attention on any one thing long. The suit went against him, and he soon after was brought to the asylum. In another case the president of a bank, a man of wealth and irreproachable character, forged a large check, put the money in his pocket, and the day after was amazed to find the money and to account for it. In an investigation it was proved that he suffered from these blanks of memory after drinking wine freely ; that he had before done many unaccountable acts, apparently fully conscious at the time, and yet afterward disclaimed all memory of them, a fact which was supported by their motiveless character. This mental condition may be described as a loss of memory and consciousness of present and passing events, that is concealed and not apparent from a general study of the conduct ; or, in other words, a state of the brain similar to somnambulism in respect to the unconscious character of the acts, and all recollection of them. For the time being the sufferer is a literal automaton, giving little or no evidence of hisactual condition, and acting from impulses unknown, and motives that leave no trace.

The late Dr. Beard believed this state to be one of general lowered brain-function, in which the cerebral activity is concentrated in some limited region of the brain, and is largely suspended in the rest. He also urged that the plane of consciousness was below the point of remembering ; hence these cases were conscious at the time, but the memory failed to record the impression. In confirmation of this, the late Dr. Forbes Winslow recorded a case of a somnambulist who, while walking about, set his night-dress on fire, and with excellent judgment and coolness threw himself on the bed and extinguished the flames, then resumed his walk, and awoke next morning with no memory of it, and was greatly alarmed at the charred appearance of his dress. Whatever the pathology may be, it is clear that this is a state of irresponsibility, and for the time being a form of dementia and insanity, about which there can be no question. Careful study of these cases for many years has indicated the startling fact that they are very common in inebriety ; also that in every case where alcohol is used to excess there are histories of loss of memory and consciousness of acts committed while using spirits. These conditions are almost infinite in variety and complexity, and are considered mere freaks of memory by many persons. Probably in a majority of cases in the early stages these blanks of consciousness and memory are partial, and appear in the

delirium or stupor which follows excess of spirits, or in mental states approaching it, and clear up after recovery, or remain like a cloud for weeks, then from some little circumstances break away and every act is recalled. In other cases only a dim, vague impression remains of what has transpired in the past, which may or may not become clear with time; or the blank may be total for the time being, and then break away. In many of these cases there is apparent realization of all his acts and words, in others a self-evident unconsciousness of them. This is only the beginning of another and more pronounced stage, in which the blank of memory and consciousness is total, and during this period the acts and appearance of the person differ but little from those of usual health. In many cases the brain function or action, as seen in his acts, is fully up to the best state of health, even showing more than usual strength in some directions. In a paper read before the Medico-Legal Society of New York, in 1881, I discussed this condition as a trance state following inebriety; since that time a number of different names have been suggested by authors, such as inebriate automatism, inebriate insanity, inebriate unconsciousness—all describing the same condition. The following may be mentioned as facts that are generally accepted as landmarks from which further study may be dated:

1. This trance state is a common condition in inebriety, where, from some peculiar neurotic state, either induced by alcohol, or existing before alcohol was used, or exploded by this drug, a profound suspension of memory and consciousness and literal paralysis of certain brain-functions follow.

2. This trance state may last from a few moments to several days, during which the person may appear and act rationally, and yet be actually a mere automaton, without consciousness or memory of his actual condition.

3. This trance state may be noted by criminal impulses and by unusual thoughts and acts foreign to all the man's past history. In all these cases there are no apparent disturbances of the nervous system, no convulsions, no premonitions to mark this state; at some unknown point, all unconscious, the eclipse begins. A comparison of the history of a number of cases will show three mental conditions quite prominent: 1. In which the mind in this state acts along certain accustomed lines of thought and action; 2. In which the mind displays unusual ranges of thought and action, which in some cases can be traced to certain mental states growing out of the surroundings; and, 3. Where criminal impulses are prominent, that have no apparent connection with the present or past. These conditions may be illustrated in the following cases: A railroad conductor, who drank to excess every night after the day's work was over, would frequently get up in the morning, go out on his train, perform all his duties correctly, and recover consciousness of himself suddenly on the

road, and all the past be a blank to him from some point the night before. These blanks occasionally lasted twenty-four hours, and he could never recall anything which happened, and only knew by the money and tickets that he had made a trip on his train. After a time he would put down in a note-book events of importance in this state, which he never did otherwise. The train-hands knew that he was, as they termed it, "memory-drunk," when he used his note-book freely, and seemed dull and abstracted. A pilot on a Sound steamer, after seasons of hard work, and exhaustion from loss of sleep, would use brandy to keep up, and have blanks of hours from which he would recover, having no recollection of what had happened. He would act as usual, only be less talkative, and dull in his manner. A skilled mechanic, who used spirits to excess, suffered from blanks of many hours' duration, during which he attended a dangerous machine, performing all the duties, requiring both skill and judgment. A clergyman, who drinks wine, has frequently conducted service, and preached a sermon without any memory of the fact, having a blank of all surroundings for hours. A grocer, after a period of great excess in the use of spirits, will conduct his business for hours without any consciousness of events, and only know by the books and the statements of others what has taken place. These are only a few of the histories of a large number of cases which I have gathered to illustrate the fact that in this trance state the mind may work along accustomed lines of thought and action. In this condition, the evidence of a mental blank is more or less obscure. In the next division, the mind displays unusual ranges of thought and action, some of which can be traced to the surroundings. A physician, who drank constantly, and was a bitter skeptic, went into a revival meeting and professed change of heart, and took part in the exercises, and the next morning had no recollection of it. Later, while drinking, he heard the singing of the revival meeting, and, dropping all business, entered and took a very active part, and seemed fully conscious of all the surroundings, yet, after a night's sleep, had no recollection whatever of anything which had occurred. In this case the trance state was manifest in unusual deeds and acts, suggested from the surroundings. A similar case was that of an editor, who, after drinking to excess, could always be found in temperance-meetings, making eloquent appeals, and yet he gave no evidence of being under the influence of spirits, nor could he remember anything of what had occurred. Another case is that of a man of fortune, who drank wine freely, awoke and found that he had married his servant, and made an unusual disposition of his property, which was all a blank to him. To his friends and others he seemed fully conscious of the nature and consequences of these events at the time. I think it will be found that inebriates brought suddenly into conditions of excitement are moved by circumstances and surroundings to which they are often really oblivious. If the trance state is pres-

ent, the influence of the surroundings can not be estimated. The last division, that of *criminal impulse growing out of this trance state*, illustrates the subject of our paper more closely. The following cases bring out the facts better than any description: An inebriate was repeatedly arrested for horse-stealing, and often punished. The crime was committed under similar circumstances, and no attempt was made to conceal the property; on two occasions he assisted the owner to hunt up the horses. When it was apparent that he was guilty, great was his astonishment, and he denied all recollection of any circumstances or events. This was confirmed by all the circumstances of his life, by his inebriety and blanks of memory, and absence of motive and object in the crime. He was fond of horses, and seemed at this time to be governed by an impulse to drive and ride behind a good horse. A farmer of quiet, good disposition suffered from blanks of memory after drinking to excess. One day, in what seemed full consciousness of the surroundings, he attacked a stranger and injured him so that he died. He had no recollection of the time, purpose, or any circumstances of the tragedy. A periodical drinker, of wealth, fired his buildings, and awaking when they had burned down, offered a large reward for the incendiary. To his great astonishment, the fire was readily traced to him; the circumstances and motive were all a perfect blank. A man of much talent and eminence, who drinks occasionally to excess, has on many occasions offered violence to his wife, whom he loves very dearly. On these occasions he is apparently sober, gives reasons for his conduct, and afterward has not the slightest recollection of it. In a murder-trial recently, it appeared that a drinking man drank early in the morning, then killed his wife, and went about his work in the vicinity, as if nothing had happened, all unconscious until arrested. He was sentenced for life, but has a firm conviction that he did not commit the crime, because he can not conceive of a motive, and has no recollection of it. A clergyman committed a rape under the most extraordinary circumstances, and denied all recollection of it; his drinking habits and all the incidents of the case sustained his statement. A lawyer of reputation planned the abduction of a lady he was going to marry. A man of a large family and happy domestic relations married a notorious woman. A physician stole a large sum of money from a patient. A college graduate enlisted in the army. In each of these cases there was a history of drinking to excess, and each had no memory of the event, and all the circumstances were so unusual and at variance with previous conduct that undoubtedly a trance state was present. These cases might be multiplied almost indefinitely from the records of criminal courts everywhere. Every day the papers record cases of crime, without motive or purpose, by inebriates who, in defense, claim to have no recollection of it; but, as they were not wildly delirious or stupid at the time of committing the act, they are punished as fully responsible. When the crime is of magnitude, and

the defense is insanity, the explanation and theory are so far from the accepted views of experts as to confuse courts and juries, and be criticised and ridiculed by others. This defense occurs most frequently in two forms of cases: One, of a chronic inebriate, who is all the time more or less under the influence of spirits, and who lives in a low moral atmosphere, in bad physical surroundings. Suddenly he commits a crime, which is without motive, and seems a mere accident and result of unforeseen conditions. The second case is of a man who may be a periodical inebriate, and of good character and reputation in everything except excess of use of spirits; whose surroundings and general standing are good, and who commits a homicide or some strange crime under circumstances that are inadequate to explain or account for it. In both of these cases there is no recollection of any of the circumstances, and the defense is based on some specious reasoning and theories. There are evidently disorganized brain-power, mental and physical incoordination, with defect and unsoundness of the reasoning powers, which can not be made clear to the court and jury. The prevalence of the theological theory, that all these strange, unaccountable acts of inebriates, who are not stupid at the time, or wildly delirious, come from vice and sin, is fatal to all scientific study and progress. This condition of trance, noted by absence of memory and consciousness, has been discussed by Dr. Carpenter, of England, under the title of "Automatic Cerebration," from which I quote the following sentence: "I have noticed some cases of drunkenness, in which a suspension of memory and consciousness was noted, coming on unexpectedly, and then the patient was a victim to morbid impulses which he never realized or had any recollection of after." Dr. Hughlings Jackson writes at some length on mental automatism, following transient epileptic paroxysms, in which this same condition is described at length as a form of sudden paralysis of the cerebral functions, or conditions of hyperæmia and suspension of some controlling centers. The late Dr. Forbes Winslow describes a similar condition of trance and automatism where the person seemingly acted as fully recognizing right and wrong, although consciousness was obliterated. Dr. Hammond mentioned the case of a man who, after an attack of epilepsy, went about for eight days in a trance state, doing business, and having no memory of it. Dr. Hughes has also mentioned similar cases. Abroad many eminent specialists, including such names as Drs. Bucknill, Clouston, Mercer, and Motet, of Paris, and others, have described this state associated with epilepsy, and following mental shocks in persons who are drunkards. These references are presented to show that the trance state has been observed by eminent men, although not yet studied from the side of crime and responsibility. A large number of cases are constantly before the courts on trial for crime committed after and during excess in the use of alcohol—crime that is purposeless, without motive or object, and differing in the manner of execution, and effort to conceal

afterward, from other crime of similar nature—in some cases noted for apparent coolness, without excitement, and cold-heartedness or indifference to the nature of the act. In the defense, all recollection or consciousness of the event is denied, and many circumstances, seen both before and after the crime was committed, bear out this statement. These cases receive no study, and are punished, the result of which precipitates the victim into worse and more degenerate stages. Undoubtedly these cases are suffering from alcoholic trance, and have crossed the border-line of sanity and responsibility, and are as truly insane as the wildest maniac. In this trance state the person is a mere automaton in motion, either moving along certain fixed lines of conduct, or acting in obedience to unknown forces which may change or vary any moment. Some governing center has suspended, and all rememberable consciousness of time and the relation of events has stopped. Changing thoughts and impulses, the suggestion of a disturbed organ, or the impression of a thought or desire felt in the past, may suddenly concentrate into action irrespective of consequences. Both subjective and objective states, influenced by conditions of health and brain-power, may develop into acts that will be unknown and unrecorded by the higher brain-centers. Clinical facts within the observation of any one will indicate, without any kind of doubt, that in all cases of inebriety there are a defective brain-power and ability to recognize the natural relations of life in all particulars. The sufferer is more or less incapable of healthy normal thought and action; he has opened the door for many complex nervous disorders, and the natural process of tearing down the structure is greatly accelerated. If the trance state is found to be present, he has passed into the realm of practical irresponsibility and unconsciousness of the nature and character of his actions. I believe the following summary will be found to outline the future recognition and treatment of these cases:

1. Inebriety in all cases must be regarded as a disease, and the patient forced to use the means for recovery. Like the victim of infectious disease, his personal responsibility is increased, and the community with him are bound to insist on the treatment as a necessity.

2. Inebriety must be recognized as a condition of legal irresponsibility to a certain extent, depending on the circumstances of each individual case.

3. All unusual acts or crimes committed by inebriates, either in a state of partial stupor or alleged amnesia (or loss of memory), which come under legal recognition, should receive thorough study by competent physicians, before the legal responsibility can be determined.

4. When the trance state is established beyond doubt, the person is both physiologically and legally irresponsible for his acts during this period. But each case should always be determined from the facts of its individual history.

In the light of science the present legal treatment of inebriety is

but little else than barbarism. The object of the law, in punishment, benefits no one, and makes the patient more incurable—destroying all possibility of recovery and return to health again. Inebriety in any form may be no excuse for crime in a legal sense, but it is still less an excuse for punishment, which destroys the victim, or makes him more helpless and hopeless. A vast army of inebriates, hovering along these border-lands of disease and crime, who are unknown and unrecognized, except "as vicious and desperately wicked," are a perpetual menace to all progress and civilization, unless they can be reached and checked by rational, effective methods. A revolution of sentiment and practice is demanded, in which the inebriate and the conditions which developed his malady shall be understood; then the means for prevention, restoration, and recovery can be applied along the line of nature's laws.

THE PROBLEM OF UNIVERSAL SUFFRAGE.

By ALFRED FOUILLÉE.

THERE are three principal theories of suffrage. It may be regarded, first, as the final shape assumed by the struggle for existence among mankind. Since it is necessary, sooner or later, to come to a treaty of peace, let us make it before the battle, instead of afterward; let us put ballots in the place of gun-shots. We can thus gain an economy of men and strength, and a reserve of living power. Universal suffrage may be defined, from this point of view, as a device of modern society to make a canvass of its forces, and learn what proportion of them is arrayed on the one side or on the other.

The second theory is based on considerations of utility and common welfare. Modern nations, in their advancing freedom, are happy only as they do definitively what they wish, as they recognize in their present condition the result of their present will, while they reserve the power of modifying their situation on changing their wish. Though the opinion of all may not be the best possible, it is at least the most fit to satisfy everybody, and experience will teach wherein it may need amending. But what if it is too late to amend? Some experiments may lead to the loss of a province, or to the ruin of the nation. Mr. Spencer, indeed, tells us that as the vote of each individual is the expression of the wants that he feels, so the votes of the nation are the product of a generally felt want. But we reply that individuals can not feel or account for general wants, especially when they concern international affairs. Even in the internal affairs of a nation, a general want is not the simple sum of particular wants. There are superior interests, not intellectual, æsthetic, and moral only, but economical and political ones also, of which individuals as a mass can have neither

knowledge nor the mere feeling. On this point Mr. Spencer remarks that, although the vote of the people is not the expression of absolute utility and truth, it is the expression of the people's understanding of them, and of what they are ready to maintain. True ; but is the present moment all? Must we not think of to-morrow? The fault of the masses is want of foresight. They are instinctive, not reflective. To calculate the remote effects of a measure, to rise to the point of view of future generations, to be moderate now, to give up immediate pleasures for future good, perhaps for the sake of an idea that will never be realized, passes the scope of average minds. The fate of democracy is, then, subordinated to the existence of a real public and impersonal spirit in the majority of the individuals: if this spirit does not exist, universal suffrage is only a strife of individual interests—it dissolves the masses into their atomic elements, then arbitrarily gathers up the atoms, and scatters them to the winds. It may be said, and with truth, that the best means of developing a genuine public spirit in a nation is to call the whole people to political life, and that the participation of all in power is an exercise useful to all, and one that develops knowledge of the national affairs in all. But an important distinction must be made in the matter. It is the conquest of power, not its completed acquisition, that gives the most lively stimulus to progress in political intelligence. While the people are contending for their rights against oppression, their intelligence is growing ; when the masses have become preponderant, the current sets in in the contrary direction. Those who have the supreme power, whether it be one, a few, or many, have no longer need of the arms of reason ; they can make their mere will prevail. Men who can not be resisted are generally too well satisfied with their own opinions to be disposed to change them, or to be told without impatience that they are in the wrong. John Stuart Mill was right in conceiving that the best interest of democracy consisted in giving the different classes force enough to make reason prevail, but not enough to prevail against reason. The existing organization of suffrage is far from securing this guarantee.

The third theory of universal suffrage, higher and more correct than the theories of force and interest, is based on right. Public freedom is above public force and public interest, and is founded on individual freedom. The individual has no right to alienate, for the benefit of another, his own liberty and that of his descendants. The object of universal suffrage is to reserve the will of generations to come, and for that reason it involves the suppression of hereditary privileges, of aristocracies and monarchies, and of everything that shackles present and future freedom.

This principle is morally incontestable ; but the consequences derivable from it do not seem to be generally comprehended. From the point of right, suffrage seems to us to imply—1. A power over one's

self. 2. A power over others. 3. A public function exercised in the name of the whole nation. Most democratic theorists see only the first of these characteristics. The function of preserving individual liberty within the state is, indeed, one of the ends of suffrage; but, in voting, I not only vote for myself, I also exercise a power over the domain of other persons as they do over mine, just as much as though the question were one of the conveyance of an estate, or the division of its proceeds. This power over another, multiplied by the number of the voters, or of the majority, may become something formidable. Hence arises a second opinion that regards suffrage as a part of the power allotted by a reciprocal contract to each associate in the great civil and political society. Although this conception has a relative degree of truth, it appears to us to rest on an incomplete idea of the state. The state is not an arbitrary association, but one in which the members are bound in an historical and organic solidarity. Suffrage further acquires a third character, and appears as a social function, or a function of the collective consciousness. By means of it, we may say, all the cells of the political body are invoked to take their part in the intellectual and voluntary life. But the idea of function involves the idea of capacity to perform the function.

To see in suffrage, as is nearly always done, only a single aspect—whether it be the individual, or the contractual, or the social side—is to lose sight of one of its three constituent relations; the relation of the individual to himself, that of the individual to other individuals as such, or that of the individual to the state as an organic whole. In these three points of view, the right supposes a capacity—1. To govern one's self; 2. To exercise by the ballot a power over another; and, 3. To exercise a social function in the name of the state. This, if we are not mistaken, is the real and complete conception that embodies in the germ the whole philosophy of universal suffrage.

The part of the state is not generally better comprehended than that of the individual. The omnipotence of the state, falsely asserted by the radical school, becomes in practice the omnipotence of majorities. Actual democracies are simply the government of all by the largest number, instead of the government of all by all. The confusion which democrats here make of the universal right of suffrage with the practical expedient of majorities involves grave consequences and deserves to be examined.

The ideal of a perfectly free society would be that every law in it be the work of the unanimous will. Unanimity, the only adequate form of general liberty, already exists upon a number of points. We all desire to live in society, and to enter into the social contract; and we all prefer to live in that particular society which constitutes our nationality. There are also some things within that nationality on which unanimity exists. We all want roads and railroads; and, excepting the thieves, we all want police and courts. But there is a

point where divergences arise, and conflicts of opinions, interests, and rights. What are the means, when we come to divide at this point, of still securing the greatest agreement of liberties, and, in consequence, the highest degree of justice?

The points on which opinions are divided may be not incompatible with each one following his own choice, or they may be irreconcilable. In the former case there need be no difficulty in arriving at practical solutions, the scope of which should be extended as much as possible. By an intelligent decentralization, society may be broken up into groups, smaller and smaller, one after the other, without ceasing to be united at the common points. But who is to control in these circumstances, when the different wills are absolutely incompatible? Partisans of aristocracy say, those who have reason and right on their side. But how are we to ascertain who they are? We have no criterion for recognizing the bad and incapable as we have for distinguishing the infirm, the lame, and the diseased. Education is not a sufficient criterion of political capacity, for it does not do away with prejudices or with selfishness. Restricted suffrage, according to the lessons of experience, has exhibited the same vices as the suffrages of the greater number—corruptibility, prejudice, vanity, ignorance, distrust of liberty, and dependence. The middle and upper classes have no right to consider themselves better than the populace. Like the populace, they have their egotistical—or, as Bentham styles them, their "sinister"—interests, in opposition to the general interest. Wicked and incapable persons are as often met with in oligarchies as in the mass of the nation. History shows that all aristocracies have perished by their vices and incapacities, and that those who are assumed to be the best are frequently the worst. In calling all the citizens to power, under suitable conditions of capacity, we are doubtless exposed to the danger of calling in some worthless men, but we are still more exposed to it if we confer a privilege upon particular classes. The only difference is that, if the evil element exists in a close aristocracy, it soon corrupts the whole body; while, if it is scattered in a mass always open and mobile, it suffers dilution, and finally elimination. We are obliged, therefore, in the question of suffrage, to consider solely the quality of man and citizen aside from mental and moral qualities. As we can not weigh heads, we must count them. It is logical, when there is conflict, for numbers to decide, not because they are numbers, but because they represent the preponderance of rights and wills: "We unanimously agree to be governed by the majority." Those who do not approve this decision must submit, or step down and out. That is the principle on which the recognized right of majorities rests. But, although a necessary convention rules here, there is nothing in it to justify the pride of triumphant majorities, and the pretense that they represent, by the mere fact of their numbers, the national sovereignty. Majorities should be taught to comprehend that they are only

a provisional and feeble substitute for the universal will. They should not be allowed to persuade themselves that they necessarily represent truth and justice. And they should always remember that they were a minority before they became a majority. It is a law of history that every true and progressive opinion was at first that of a single man, then that of a minority, before it became that of the largest number. There are, then, great chances that the opinion of the future may be residing in one of the minorities that have been overcome by the majority; but in which? It is impossible to know. The error that is passing away and the truth that is coming are both in a minority; and it is precisely because we have no sufficient criterion to distinguish the dawn from the twilight that we content ourselves with the average opinion as offering the least chances of error and the most perfectible elements.

When a decision is to be made, the views of the majority and the minority can not, as we have seen, be reconciled; but, while the matter is under deliberation, they can be compared by giving a representation of all the opinions and permitting their expression. The brain can not decide for two contrary things at once, but it can deliberate over the conflicting views. The case is the same with the kind of national brain called a parliament. Mirabeau has compared representative assemblies to geographical maps, which should reproduce all the elements of the country with their proportions, without permitting the more considerable elements to overshadow the less considerable ones. Now, how far ought the proportionality of representation in such bodies to go? Should it aim at a nearly mathematical exactness, as the partisans of Mr. Mill and Mr. Hare demand? It may help us, in answering this question, to examine the nature and function of the different parties, of which we propose to assure the exact representation. In the view of social science, two kinds of forces are indispensable to the body politic, as well as to every living organism—conservative and progressive forces. These forces are personified in the two great parties that prevail in all modern states—the conservative liberal and the progressive liberal parties. Instead of mutually hating each other, these parties ought to comprehend that they are necessary one to the other, and both to the whole. From a psychological point of view, the state, which is an exaggerated man, and condenses in itself all the living forces of the man, should include simultaneously parties distinguishable from one another by differences corresponding to the successive ages of the individual. M. Bluntschli has constructed a fine psychology of parties, which, however, goes a little too far. Childhood is represented by radicalism. All the thoughts of childhood are for the future. A new world is opened before it, which it believes it can organize according to its fancy. Every formula taught in school seems to childhood a universally applicable truth; the radical thinks the same, and ascribes a magical power to his laws and institutions.

The child loves to push things to extremes, and, armed with his petty logic, goes from destruction to destruction without concerning himself about obstacles. How many theorists have reconstructed the state in the same manner! Universal suffrage should never forget that radicals may be good opponents, but are detestable governors. Unfortunately, in the real world of the ballot, even the violence of the radicals has a chance of success with the masses, to whom often it is enough to promise everything, to get everything from them.

The liberal progressive spirit corresponds with the age of youth and early manhood, which is especially distinguished by the development of the productive forces. The young man endeavors to assert himself, to produce, to take his place in the world. Liberal natures offer the same character, and the organizing power which they show is the infallible sign of true liberalism. The liberal loves liberty above everything else; but he suspects liberties that are granted or gotten up for the occasion. He has faith only in liberty that is innate, or that has been conquered by labor and effort. Progress is his aim.

The conservative liberal is the man, some forty or fifty years old, who is less concerned about acquiring new possessions than about improving and expanding those that he has. The conservative is less enthusiastic than the progressist, not that he does not appreciate his ideas, but because he more clearly sees the difficulty of realizing them. As the progressist above all loves liberty, the conservative loves pre-eminently the law which gives force and stability to relations that are recognized as necessary. Further, he attaches himself particularly to historic right, of which he maintains even the traditional form. He wishes the movement toward the future to respect the rights of the past. Thus he is little aggressive, and his particular force is the defensive. His natural place is after a revolution, or a fundamental transformation, when the living question is to preserve the conquests that have been made, and secure them against new abuses. Great legislators are generally progressists; great jurists are for the most part conservatives. Reactionary absolutism corresponds with old age, when life is declining and approaching its end, and the passive elements become preponderant. Its ideal is passive obedience; but, if its tranquillity is disturbed, it becomes irritable and cruel.

While we may recognize the part of truth in such a psychology of the parties, we need not believe that each age is rigorously analogous to any of the characters mentioned; the affair is one simply of general tendencies and means, which do not exclude individual differences. The progress of the state will be regular and consistent with a just conservation of acquired results, if the national representation is composed of two great liberal parties, one progressive and the other conservative, with a few elements of radicalism counterbalanced by a spice of absolutism. The two extremes are gradually becoming more restricted, to the advantage of moderate and liberal tendencies, and

suffrage should be organized so as to prepare for this result. It should be the object of democracy to accord the right of deliberation to all the constitutional parties in proportion to their strength, and to lodge the right of making a decision in the progressive liberal, counterpoised by the conservative liberal element. It is, however, not easy to achieve a practical realization by mathematical processes of the ideal of proportional representation; and the separation of the power of deliberation and the power of decision is hardly practicable under existing constitutions, by which the same assembly deliberates and decides. Philosophers should, nevertheless, continue to point out the end to be sought.

Besides the opposition of the majority and the minority bringing about a conflict of the constitutional parties, universal suffrage embodies another antinomy no less disquieting—that of the number and the quality of the votes. The problem of reconciling numerical superiority with mental superiority is a squaring of the circle for democracy. As approximative solutions, it has been proposed to express intellectual superiority by a numerical valuation, and allow a plural vote to the educated man; and so to instruct and enlighten the whole mass that the number of the suffrages shall, on the whole, coincide with their quality. John Stuart Mill has insisted upon the former method, or "plural suffrage," but the system is not without its dangers. It opens the door to arbitrary selections. Particular classes, assuming too many votes for themselves, would finally become oligarchies, the more probably because the educated classes are also those in easier circumstances. The only case in which a plurality of suffrages would be, in our view, at all admissible, would be that in which the individual really represented several persons, as the father of a family, who might, in virtue of his wife and children, have two votes. The best means of resolving, in part if not entirely, the antinomy of right and capacity is, in our view, education; but its character should be rightly understood.

By the theory of universal suffrage, the mass of the citizens should desire the general good rather than their particular interests, and they should have a sufficient discernment of it to impress good direction on their policy. Education should, then, develop, as the two essential qualities of the citizen, moral disinterestedness and political sense. Our present system of education does not seem to respond, in any of its departments, to this double requirement. We owe much to the mathematical and physical sciences that are now held in so much honor, but we have no reason for believing that they are competent to make citizens morally disinterested or politically capable. Purely scientific instruction has proved no better for this than that which is purely grammatical. Criminal statistics has not shown that any great advantage accrues even to those who simply know how to read, write, and reckon; but it has revealed more criminality among working-men

than among peasants, even though the working-men may be the better instructed. Some statisticians have remarked that the moral influence of knowledge begins to be real at the moment when learning ceases to be a tool to become a work of art. To exert a moral influence is, in fact, to raise minds above egotist views and purely material interests, toward general ideas and impersonal sentiments. For that reason, instruction should be not only professional, and technical or scientific, but literary and æsthetic as well.

The citizen of a democracy must, further, have precise knowledge in public polity, and this should be made obligatory. It may be that a man has a right to be and continue incapable in matters that concern himself alone, but that can not be allowed in affairs that concern all. Society as a whole must demand some guarantees from the associated individuals—a certain maturity, not of age alone, but also of intelligence and education. John Stuart Mill says that the elector ought to be able to copy a few lines of English, and do a sum in the rule of three. We have not much faith in the virtue, in this matter, of the rule of three. Reading, writing, and arithmetic are double-edged blades; everything depends on what one reads and how he uses his arithmetic. Mr. Spencer remarks with much force that the multiplication-table will not help one to comprehend the falsity of the socialist dogmas. What good does the laborer's ability to read do him if he only reads what confirms him in his delusions? The higher grades of instruction are doubtless more efficacious than the primary; but they are far from being of themselves competent to develop political capacity. Mr. Spencer, having shown how poorly prepared is the English university graduate, with his knowledge of Homer and Sophocles, to perform his duties as a member of Parliament, adds that to prepare a person for political life he ought to be given education in politics, while the contrary is done. Yet, when we wish to teach our daughters to become good musicians, we do not furnish them with a painter's apparatus, but seat them in front of a piano. The classical studies, so much criticised, have at least an æsthetic and moral influence, if they do not develop the political sense; but the study of the sciences, as it is ordinarily pursued, has neither of these advantages. Our courses are overcharged with historical and scientific studies, the tendency of which is to overload the memory of the pupils, without developing their judgment or elevating their character, and the result has been deplorable. Courses charged with calculations, analyses, and classifications, can not even contribute to the moral and intellectual elevation of the mind. There should be taught, besides the elementary and practical principles, the most speculative principles, and the most general results of the sciences, or, in short, their philosophy. In this way only has science an educational virtue; in this way it lifts the mind instead of merely furnishing the memory, and is liberal instead of servile and military. As usually taught, it serves only to

prepare, for examination-day, answers the most of which will be forgotten a month afterward.

But we are asked, Is not science the investigation of truth, and does not this imply a love of truth, a disinterested love fruiting in abnegation and sacrifices? Oh, yes, a great scientific man has said that truth surrenders to the patience of students, to simplicity and devotion as well as to genius. But the search for truth is one thing, and truth already discovered and taught passively is another thing. In scientific instruction, as it is commonly given, only acquired results are presented to the pupils, without teaching at the cost of what efforts they have been gained—only truths that have been cooled off, lifeless truths and soulless formulas. For moral effect, we should give the history of science and of scientific men, intermixed with the exposition of the sciences; but we prefer to teach a hundred more theorems or formulas, which our pupils hasten to forget. Thus taught, separated from philosophy and history, science has neither moral virtue nor civil import. It degrades instead of elevating, makes machines and not men, still less citizens. A considerable part should, then, be given, in teaching of every grade, to letters, the arts, and the moral, social, and political sciences. On this point Mr. Spencer and M. Bluntschli agree in the assertion that there can be no liberty, no vote in democracies, without a good political education. The child can hardly grasp the idea of the state, and can only receive extremely vague and dull notions respecting the political constitution. He should be inspired with ideas of public morals, civic virtues, and patriotism, and rather by examples than by precepts. This political instruction should be continued in a higher and more practical but always unpartisan form for youth who are approaching the time when they will exercise the right of suffrage. It is as dangerous to thrust into political life young persons who are strangers to all political knowledge as it is to send soldiers into battle without having drilled them in military exercises. Defense against the assaults of internal barbarians is as essential in democracies as defense against foreign invasions. Examinations have been instituted in Belgium for candidates for admission to participation in the right of suffrage, and the example might be a good one to follow.*

* The new electoral law of Belgium establishes, as the basis of the electorate, a standard of mental and moral capacity. A jury subjects the candidates to an "electoral" examination upon simple questions of morals, Belgian history, constitutional institutions, reading, writing, arithmetic, and geography. Before coming to this point, experiments were made upon the results of primary instruction. Cadets, who had been five or six years at school, were put to the test of an extremely simple examination. They were asked, for example, to tell the four large cities of the country, and the rivers on which they are situated. Thirty-five per cent made no answer, and forty-nine per cent only made a partial answer. To the question, By whom are the laws made? fifty per cent had nothing to say; twenty-eight per cent replied, They are made by the king, or by the king and queen, or by the ministers, or by the Government, or by the Senate; and fifteen per cent answered with knowledge. When asked to name an illustrious

Not only should primary political instruction be extended and fortified, but a secondary and superior political instruction should be created, for they do not exist in France. We some years ago made a demand for the introduction of political economy. It has since obtained a modest place in the course. It is now time to demand political and juridical instruction. Superior political instruction is in the most incomplete condition in France. In Germany, chairs of Public Law and Social Science are established in all the universities. The same is the case in Holland, Belgium, and Italy. M. Bluntschli occupies a chair of this kind at Heidelberg; can it be otherwise than that a professor of his talents should have rendered great services in so important a course? A free school of political science has been successfully organized in Paris, to fill the want of superior political instruction which is so apparent. It has been well said that France, more than any other country, ought to have professors charged with the duty of studying the conditions of the best government, and communicating the results of their labors to the public, for France overthrows its government and looks for a better one every twenty years. The scientific study of political questions would doubtless moderate this ardor for change, by showing to all how difficult the questions are. Lacking this, we have to be contented with plans of social organization improvised by journalists. In Belgium, the state has instituted a diploma for political sciences, which is a title of preference to administrative functions. As M. de Laveleye remarks, this is the only means of securing a sufficient contingent of assiduous pupils, and of diffusing the serious knowledge of political science through the country. The classes called superior must become worthy of their name. The movement will have to come from them and be spread through the totality. Moved and directed by them, popular suffrage will be, as has been said, useful by means of its sheer inertia, as the fly-wheel of a machine regulates and augments the force of the motor.

In the struggle of the nations for existence, the future will assure the triumph to the people who best comprehend that the highest intellectual, moral, and social culture is also the most necessary to its grandeur and power. The more democratic a nation is, the more it is inclined to be utilitarian, and yet it must not be wholly utilitarian. It wants an abundance of the moral and æsthetic. The true means of resolving the antinomies of universal suffrage is the widest possible distribution of the highest possible instruction. In this, society has only to follow the example of Nature, which causes unequal beings to rise from the equality of the mean. Of seeds under the same cultivation, those which are fruitful are sifted from those which are sterile. Two men, of nearly like intelligence, are working in a field; instruct

Belgian, sixty-seven per cent cited foreign notabilities of all kinds and from various places, and twenty per cent could name only Leopold I or Leopold II. Such were the insignificant effects of the Belgian law of 1842 on primary instruction.

them, and while one continues a laborer, the other may become a great light, a Laplace or a Faraday. Your equal instruction has freed the latent forces of superiority. The same is the case in the political field. Joined to a universal instruction, the effect of the equal right of suffrage will be, not to suppress the directive power of the whole, the superior authority, but to constitute it by an intelligent selection. While universal suffrage still leaves the door open for natural superiorities, these in their turn finally bring about a new equality with the level higher than before. This is the principal difference between the struggle for existence in the animal kingdom and competition in the human kingdom. The animal, which, by selection, has acquired a better dentary system, transmits its superiority to its own line, but not to other animals. It produces a kind of aristocracy. With mankind, however, a discovery made by one people is finally spread to other peoples. The error of demagogism and socialism consists in their not asking whether the present inequality, which raises certain superior individuals or classes above the crowd, when it is natural and not factitious, may not be the germ of an equal advancement in the future for all. True democracy aims at universal elevation, not universal depression, and to make power accessible to all superiorities, whoever may be the man or whatever class may have produced him. If our people receive such a superior instruction as we have proposed, we shall have Chambers composed of men versed in political economy, politics, history, and jurisprudence. We can not in this matter rely upon the spontaneity of individuals, any more than upon primary instruction. At present, the more easy classes are almost as deficient in true social and political knowledge as the masses. We complain of the incontestable mediocrity of our governments. It comes much more from the governors than from the governed. It is due to the defective education of those who have the duty of directing, to our poverty in superior men. But they say democracy is jealous. Envy is a vice of aristocracy as well as of democracy. Has democracy in France ever held out long against genius and talents when they have manifested themselves? Did it repel M. Thiers while he was living? Where to-day are any great political talents to which universal suffrage has refused its commission? Knowledge, justice, and truth, exercise a natural and inevitable ascendency over all peoples who are not composed of barbarians. Individuals and the masses only ask to obey whenever a natural authority exists and manifests itself. Wherever superior forces do not govern, it is because they do not exist; where ignoramuses make the law, it is most frequently because no men versed in politics are at hand. Where vice is the master, it is because the civic virtues described by Montesquieu are rare or have disappeared. If universal suffrage supposes men at the base capable of choosing, it still more supposes men at the top fit to be chosen.—*Translated for the Popular Science Monthly from the Revue des Deux Mondes.*

CANNIBALISM AS A CUSTOM.

By A. ST. JOHNSTON.

THERE is a certain weird attractiveness about the subject of cannibalism, a grim fascination in its grisly horrors, that is not easily to be explained, but which, although few of us will admit it, most of us have experienced. Perhaps it is in subjective cannibalism alone that this uncanny attraction exists; objective cannibalism may not possess the same eerie charm. But the very fact that cannibalism either exists now, or ever existed, is, however, denied by some skeptical persons—mostly strict and rigid vegetarians, one would think—who argue that wild and natural races of men can not and do not lust for flesh. The fact remains the same.

It seems that this time-honored practice—crime, many unthinking and unjudicial people would call it, whose opinions have been formed without consideration of the relation of crime to custom—has, at different times, existed in almost every part of the earth. It seems to have lingered longest in the most beautiful regions of it—in Polynesia, namely, where the writer of this, but for a fortunate and timely warning, would himself have fallen a victim to the custom for which he has a feeling of respect, if not exactly of affection.

Our remote, possible forefathers themselves, the prehistoric cavemen of Europe in the Quaternary period, were addicted to this habit, which a pious feeling of respect for our ancestry should alone prevent us from characterizing as a crime. Evidences of their occasional little anthropophagistic failings, in the shape of scraped and chipped human bones which, besides being cooked, are broken in a manner too scientific and skillful to be the work of animals, are not infrequent, though it is believed by paleontologists that the custom was more of an exception than a rule. Animal food being plentiful at that time in these cold northern latitudes, the greatest incentive to cannibalism was wanting, and the very practice of it shows a tendency to epicurean indulgence and luxury that already (from a very long way off) pointed to the future extinction of their race. The ancient Irish, too, in more recent than Quaternary times, ate their own dead; and our own Saxon forefathers must have possessed a knowledge of the custom if they did not in early times actually practice it, as is shown by the Saxon word *mancta*, which occurs not infrequently in their literature.

Tales of cannibalism have also come down to us from classic times, which prove that the Greeks were at least not ignorant of it. Polyphemus in the "Odyssey" was a man-eater; and Herodotus tells us of a race of men, the Massagetæ, who ate their aged parents, going only a step further than the Feejeeans, who simply buried theirs alive. The Padæi, the father of history also tells us, ate their relatives when

they became incurable; and the Issedones did the same, resembling, in this particular, the Tupis of Brazil, who, when the *pajé* (chief) despaired of a man's recovery to health, killed and ate the invalid—a rough-and-ready method of proving that their respected chief and medicine-man could not be mistaken in his diagnosis of the case.

Our own hero-king, Richard Cœur-de-Lion, is said to have eaten human flesh during the Crusades; the popular belief of the time being that the cooked head of a Saracen had restored him to strength and activity from a bed of sickness. A verse of a contemporary ballad records this:

"King Richard shall warrant
There is no flesh so nourissant
Unto an Englishman,
Partridge, plover, heron, ne swan,
Cow ne ox, sheep ne swine,
As the head of a Sarazyne."

The probable causes for this strange variation from normal appetite are more numerous than would be supposed. Famine and the consequent insistent demands of hunger are the likeliest primary causes of this as well as of most things—the necessity for food being the first and most urgent incentive to action of all sorts. Modern stories of shipwreck, when the survivors have taken to the boats and all food is gone, or of travel in the barren wastes of Australia, show how naturally this means of prolonging life suggests itself to the minds of men ravenous with hunger, and from whom the thin cloak of civilization, with which we all hide the natural animal, has fallen away.

Enmity, hatred, and revenge are also excellent reasons for the origin of cannibalism, which would be almost as likely as hunger to have suggested it, as famine is not a constant factor in savage life, and we are led to suppose that hostility and rancor are. What more satisfactory method for the expression of detestation and contempt can be imagined, than that one should cook and calmly eat an enemy when one has slain him? The thing is then complete, *finis coronat opus*, the termination rounds and finishes the deed to a perfect whole; without this climax it were but half accomplished and entirely unsatisfactory. The happy and peaceful mind and the satisfied and replete body of a savage who has killed and cooked his foe, and eaten him, can easily be imagined, and they present a pleasant picture to the mind that is marred by no sense of incompleteness.

In many places, however, where food was plentiful, and where the people were otherwise amiable and gentle, and far advanced toward an admirable civilization—for instance, Mexico and Peru before the Spanish conquest—this custom of cannibalism prevailed, and to an extent that necessitated frequent wars for the providing of the requisite victims. Here the cause was of a more complex nature than the sim-

ple expression of hatred or contempt, or the supply of necessary food. The custom was closely associated with their religious observance; the eating of the flesh by the people, after the blood and quivering hearts of the victims had been offered to the deity, partook of the character of a sacrament as well as of a banquet. Prescott, in his "Conquest of Mexico," tells us, in his picturesque language, of the awful sacrifices to the war-god Huitzilopotchli, to whom hecatombs of human beings were usually sacrificed; and of the more epicurean and delicate Tezcatlepoca, who required but one victim, but insisted that that one must be "distinguished for his personal beauty, and without a blemish on his body."

"The most loathsome part of the story," Prescott goes on to say, "the manner in which the body of the sacrificed captive was disposed of, remains yet to be told. It was delivered to the warrior who had taken him in battle, and by him, after being dressed, was served up in an entertainment to his friends. This was not the coarse repast of famished cannibals, but a banquet teeming with delicious beverages and delicate viands, prepared with art, and attended by both sexes, who, as we shall see hereafter, conducted themselves with all the decorum of civilized life."

This shows that the custom of cannibalism in Mexico must be laid to the charge of religious feeling. The step is an easy and natural one that would lead a people who followed a strictly anthropomorphic worship to the consumption of the sacrifice which they were led to believe was acceptable to the gods. Prescott notes the same thing: "One detestable feature of the Aztec superstition, however, sunk it far below the Christian. This was its cannibalism, though in truth the Mexicans were not cannibals in the coarsest acceptance of the term. They did not feed on human flesh merely to satisfy a brutish appetite, but in obedience to their religion. Their repasts were made of the victims whose blood had been poured out at the altar of sacrifice. This is a distinction worthy of notice."

But with Aztecs, as with other peoples, the appalling appetite only grew by what it fed on, and a morbid and overmastering craving for this awful diet prompted them to frequent cannibal feasts, in which desire alone, and no religious ceremony, was the cause. Men having once tasted human flesh, like the man-eating tiger, always hanker after it with a strange and morbid pertinacity that seems almost unconquerable, as is shown in the case of Feejee, where the traditional and immemorial custom was habitually practiced (and is continued to this day in remoter parts) long after the introduction of pigs.

In the Feejee and other Polynesian islands, where there are no indigenous animals, cannibalism may be allowed, perhaps, some excuse. Man is by nature carnivorous as well as graminivorous, and the natural promptings of his physical wants would suggest the food that we, with our plethora of beef and mutton, too unadvisedly stigmatize as

unnatural and monstrous. It is not to be gainsaid that in Feejee the habit quite exceeded necessary requirements; but, without wishing to deny that fact, there is much, when the question is considered judicially, to palliate the offense in those parts. Until the introduction of pigs, toward the end of the eighteenth century, the only animal indigenous to Feejee and the adjacent islands was a rat. Birds and fish there certainly were, but no other animal, and the turning to profitable account of the body of an enemy slain in battle is, under those circumstances, perhaps very easily understood and condoned with. A friend of the writer's, who settled, very early in the history of that colony, on the banks of the Wai-ni-mala River, has related to him, with graphic simplicity, many deeds of horror that he has witnessed within very recent years; how *bakōlo*, as human flesh is called there, was sent from one chief to another, much as one gentleman sends game to another in our country; and how the sound of the death-drum—heard only once by the writer, but beaten then for himself—was so frequent in his district as to pass almost unnoticed by him.

The same excuse can not be urged in defense of the inhabitants of the West Coast of Africa, who, with a supply of animal food sufficient for all their wants, still indulge, much more frequently than is credited, in this strange flesh, even in those parts where for more than half a century the elevation and improvement of the native races have been the constant labor of the resident white traders, missionaries, and inhabitants. Hutchinson, who was for many years H. B. M. consul on the Gold Coast, writes in 1861, "People in England would scarcely believe that in these days, while I write, cannibalism is almost as rampant on the West Coast of Africa as it has ever been." He quotes, in support of this statement, from the report of the sixty-eighth anniversary of the Countess of Huntingdon's Connection in that colony: "Mr. Priddy, who is employed by the society, stated that the cruel and barbarous practice of cannibalism was still indulged in during the late war; and that he saw hampers of dried human flesh carried on the backs of men, upon which they intended to feast." Mr. Hutchinson goes on to say that "cannibalism exists in the Oman country, up the Cross River; and I am informed that the Boole tribe, who reside far interior to Corisco Bay, come down the river to get some of the sea-shore-dwelling people to make "chop" of them, because they are reputed to have a saltish, therefore a relishable flavor." This last statement only shows how taste varies in different quarters of the globe, for Feejeeans prefer a brown man to a white one on the very grounds that a white man is saltish, and therefore not so pleasant.

Until Mr. Hutchinson wrote it was not generally credited that the Western Africans were addicted to cannibalism, but his evidence is not to be doubted. "In 1859," he says, "human flesh was exposed as butcher's meat in the market at Duketown, Old Calabar." It almost seems that some religious grounds may actuate them, as the same writer

says: "In Brass (or the Mimbe country) cannibalism often occurs. Even within the last year a chief of that district, named Imamy, killed two of the Acreeka people before mentioned, who were sacrificed to the manes of his father. In Brass, as in Bonny, they eat all enemies taken in war; and they put forth, as a justification for this, that devouring the flesh of their enemies makes them brave." The account given by the same writer of the killing of a native for the purposes of cannibalism, of which he was an eye-witness, is most admirably graphic and striking, but it is, unfortunately, too long, if not too terrible, to quote in these pages.

Nor is cannibalism confined to the Ethiopian and Polynesian races alone; it is prevalent to an astonishing extent among the inhabitants of the Malayan Islands, Java, Sumatra, and Borneo. Some of the earliest voyagers to the Eastern seas came back with stories of how the people of those parts were man-eaters; but, however much credence their tales may have received at the time, they have been greatly doubted since. But Marsden and other writers prove that the statements of those early pioneers of travel and observation were entirely correct. Marsden, in his account of Sumatra, says that, although he had heard reports of the cannibal habits of some of the tribes, he had always discredited them until the truth of the statement was made entirely clear to him. He says that the Battas, one of the peoples of Sumatra, eat human flesh regularly, not to satisfy the cravings of hunger, but as a sort of ceremony to show their detestation of certain crimes by this most ignominious punishment, and as a savage display of revenge and insult to their unfortunate enemies. People killed or badly wounded by them in war are eaten, and the captured sold as slaves. These same Battas show a certain amount of culinary art in the preparation of this food, for they broil the flesh over a brisk fire, and flavor it with salt, lemon, and red pepper.

A friend of the writer's, who for more than forty years has been in the employment of the Dutch Government, bears personal witness to the prevalence of the custom in Sumatra up till recent times. He was once making scientific investigations in the interior of that island, and was being entertained in the most hospitable manner by the native rajah, or chief, of the place he was then in. A feast had been made to which he was bidden, and to which he went, taking his own native servant with him. The banquet had proceeded for some time without interruption, when at last, as crown of the feast, a beautiful brown roast joint was brought from the back of the house to the open, airy place where the repast was being held. This was cut up without remark and handed round, and the Dutch gentleman was on the point of eating his portion, having raised part of it to his lips, when his servant rushed forward and stopped him, saying, "Master, master, do not eat; it is a boy!" The chief, on being questioned, admitted, with no small pride at the extent of his hospitality, that, hearing that the white

man would feast with him, he had ordered a young boy to be killed and cooked in his honor, as the greatest delicacy obtainable, and that the joint before them was the best part, the thigh.

One is too apt to associate all sorts of ferocious qualities, cruelty, deceit, brutality, and inhospitality, with the mere word cannibal, thus stigmatizing with these vicious qualities whole races of people who do but retain this one among other ancient habits and customs; whereas in reality cannibals are much the same as other folk whose food is of a less barbarous nature. The very Caribs themselves, from the Latinized name of whom the word is probably derived, the arch-types of what cannibals should be, are described as possessing very different qualities. Their tribes, the remnants of which still linger in one of the West India isles, inhabited the northern part of South America and many of the Antilles before the arrival of the Spaniards, who destroyed almost the whole race. The description their conquerors give of them is more like that of a nation of lotos-eaters than of a sanguinary and ruthless people. "They are quiet, calm, and sedentary, and given up to idleness and day-dreams," say their historians, "but are well made and possess great powers of endurance." The testimony of the writer must be given on the same side; he has had the pleasure and privilege of knowing many cannibals, Feejeean, New Hebridean, Solomon-Islander, and others, and he has, on the whole, found them gentle, quiet, and inoffensive when not engaged in the practice and observance of the special principle that they uphold. It must be confessed, however, that he had not the same appreciation of their character upon the one occasion when he ran the narrowest chance of ministering to'what he then considered a very depraved and morbid appetite.

Early travelers in New Zealand always express astonishment, when they discover the cannibal propensities of the inhabitants, that so gentle and pleasant-mannered a people could become upon occasion such ferocious savages. Earle, who wrote a very readable, intelligent, and but little known account of the Maoris very early in the present century, speaks of the gentle manners and kindly ways of a New Zealand chief, whom afterward he discovered to be an inveterate cannibal. He relates that he visited the place where was cooking the body of a young slave girl that his friend had killed for the purpose. The head was severed from the body; the four quarters, with the principal bones removed, were compressed and packed into a small oven in the ground, and covered with earth. It was a case of unjustifiable cannibalism. No revenge was gratified by the deed, and no excuse could be made that the body was eaten to perfect their triumph. Earle says that he learned that the flesh takes many hours to cook, that it is very tough if not thoroughly cooked, but that it pulls in pieces, like a bit of blotting-paper, if well done. He continues that the victim was a handsome, pleasant-looking girl of sixteen, and one that he used frequently to see about the *pah*. To quote his own words:

"While listening to this frightful detail, we felt sick almost to fainting. We left Atoi" (the chief who had killed the girl), "and again strolled toward the spot where this disgusting feast was cooking. Not a native was now near it; a hot steam kept occasionally bursting from the smothered mass, and the same dog that we had seen take the head of the girl now crept from beneath the bushes and sneaked toward the village: to add to the gloominess of the whole, a large hawk rose heavily from the very spot where the poor victim had been cut in pieces. My friend and I sat gazing in this melancholy place; it was a lowering, gusty day, and the moaning of the wind through the bushes, as it swept round the hill on which we were, seemed in unison with our feelings."

Earle goes on to relate how he, and three other compatriots whom he summoned from the beach for the purpose, with the Englishman's usual impertinent interference and intolerance of customs differing from his own, determined to frustrate Atoi's intention. They together visited the hill where the flesh was cooking, and, destroying the oven, buried the remains in the earth. They found the heart put on one side for the special delectation of their constant friend and companion, Atoi. Earle was afterward good-humoredly told by the chief that their interference had been of no avail, as they had found the grave where the flesh had been buried, and opening it, soon after he and his friends had left, had finished cooking it and eaten it all. Earle argued long, and probably loudly, with the chief upon this question. Atoi asked him what they did with their thieves and runaways in England, and he told him, "Flog them or hang them." "Then," replied the Maori, "the only difference is that we eat them after we have killed them." The same chief told him that before the introduction of potatoes the people in the interior had nothing to eat but fern-roots and *kumera* (another edible root); fish they never had in the rivers, so that human flesh was the only sort that they ever partook of.

Another early traveler in New Zealand, Ellis, who had admirable opportunities for arriving at the real motive for this custom, tells us that the Maoris "eat the bodies of their enemies that they might *imbibe* their courage"; and that they exulted greatly at the banquet upon the body of a great chief, for they thought that they would thus obtain his valiant and daring spirit.

The eastern Polynesians made war chiefly for the purpose of obtaining bodies; hence, when clearing away the brushwood from a place where they expected to engage an enemy, they cheered each other with cries of "Clear away well, that we may kill and eat, and have a good feast to-day!" Their haughtiest threat was always, "We will kill and eat you!" and to be eaten was always the greatest dread of the exiled and conquered. Dr. Turner, in his most interesting work on Samoa, tells us that in New Caledonia "it was war, war, war, incessant war," and that all the good bodies were picked out from the

dead for the oven, while the bad were thrown away. If it was a woman, they ate only the arms and legs. On Maré they devoured all. Their appetite for human flesh was never satisfied. "'Do you mean to say that you will forbid us the *fish of the sea?* Why, these are our fish!' This is how they talked when you spoke against cannibalism."

When white men first landed in Australia the degraded natives received them with the greatest respect; they considered them to be the embodied spirits of their own dead. The Australians were, and still are, in the less-known northern parts, habitual cannibals, and always eat their own dead, for fear of wasting good provision. The black bodies being scalded, when being prepared for the oven, became white as the black cuticle came away. Thus, when Europeans first presented themselves to their astonished visions, they simply and reverently received them as the materialized spirits of their scalded ancestry.

Among the Indians of America the custom does not ever seem to have been a universal one, although it was general among certain tribes. Schoolcraft relates, in his great work on the "Indian Tribes," that the Sioux will eat the heart of an enemy, and that all the war party will try to get a mouthful, believing, with the Maoris, that they gain courage thereby. Back, too, in his "Arctic Expedition," tells of a Cree Indian who had killed and eaten his wife, daughter, and two sons, and would have killed the youngest, a boy, and fed upon him also, had he not come upon Back's encampment. But this can hardly be cited as a case typical of the cannibal instincts of that tribe, as it was only brought about by the direct famine. In Terra del Fuego the otherwise unreasoning natives show a spirit of intelligent economy by always eating, in times of great distress and want, the oldest women of the tribe, as being of much less value than their dogs, which they will not kill until all the grandmothers are consumed.

But one of the strangest phases of cannibal lore has yet to be touched upon, that, namely, with which all the greatest thaumaturgists and necromancers have been accused from the days of Hadrian, who is known to have sacrificed many young lives in the prosecution of his unholy inquiries, to our own. There is some foundation for this belief in the fact that for some of the deeper and wilder mysteries of the black art an innocent life had to be offered up, from the emanations of whose spilled blood the disembodied spirits of the invoked dead could materialize themselves, and answer the queries of those daring seekers who stopped at nothing to gain their unhallowed ends. It is related that the necromancers of Thessaly added the blood of infants to that of black lambs in their incantatory rites, that the evoked spirits would render themselves objective from the exhalations of the blood. In the present day Hayti is charged with being the home of a secret sect of devil-worshipers, the Voodoos, who practice most mysterious and impious solemnities, in which children are killed and offered up, and the bodies eaten by the adepts as part of the awful ceremonial. The Rus-

sian, Polish, and indeed all the Slav races, credit the Jews with the use of this rite to this day, and it is one of the many groundless reasons that they hold for the constant persecution of that race. They believe that at the Passover a child is killed and eaten with many dark and unheard-of observances. How thoroughly this absurd tradition is credited may be learned from the perusal of the recent criminal trials in Hungary.

It has been a pleasant task to the writer to attempt, in the above pages, to excuse the habit of cannibalism among its votaries. It is always unpleasant to remain silent when one hears a comrade unfairly aspersed; just so it has been with the writer when he has read or heard of the unjust estimation in which all cannibals are held. Many, in fact most writers improperly and wrongly charge cannibalism with being a morbid and unnatural appetite; in most cases it is nothing but the expression of a natural want. The demand and desire for human flesh would die out in nearly all places were the other flesh obtainable. In those regions where cannibalism still flourishes much may be done, and is done, by the example of the first white settlers—the traders—and the teaching of the missionary, but teaching and example alone will never suffice to remedy the evil; the root of the matter must be gone to; and, to cure it, many and varied animals that are fit for food must be introduced, when the thing will right itself.—*Gentleman's Magazine.*

STARVATION: ITS MORAL AND PHYSICAL EFFECTS.

By NATHANIEL EDWARD DAVIES, L. R. C. P.

THE recent case of cannibalism at sea opens up some curious questions as to the effects of fasting on the moral nature of man. To the superficial observer, death by starvation simply means a wasting of the body, a horrible agony, an increasing weakness, a lethargic state of the brain, and a sleep from which there is no awakening; but is this all that it means? While this is going on, let us consider whether or not the intellectual faculty, and with it the power of distinguishing right from wrong, is not also undergoing a process of wasting and death, even before that of the material part, for, however dangerous it may be to received opinions to associate the material nature of brain with the moral nature of our being, we are bound to do so to elucidate some of the facts connected with this case.

Reasoning by analogy, we find that, in many cases of bodily disease, the state of the mind is the first indicator of the mischief going on in the system. Take even such a simple thing as indigestion, which, as every one must know, is only a manifestation of a deranged stomach, and what do we find? That the lowness of spirits induced

by this affection may vary from slight dejection and ill-humor to the most extreme melancholy, sometimes inducing even a disposition to suicide. The sufferer misconceives every act of friendship, and exaggerates slight ailments into heavy grievances. So in starvation, the power of reason seems paralyzed and the intellectual faculty dazed really before the functions of the body suffer, or even the wasting of its tissue becomes extreme. Such being the case, the unfortunate individual is not accountable for his actions, even if they be criminal in character, long before death puts an end to his sufferings.

The most deep-rooted and powerful feelings of human nature—the love of a mother for her offspring—are perverted in cases of starvation, for we read in Josephus that during the siege of Jerusalem, under Titus, mothers ate their own children. A similar case is mentioned in Scripture as occurring during the famine in Samaria (2 Kings, vi, 29); if, in such a case, the intellectual faculty was not utterly disorganized, no amount of human agony would account for such complete perversion of nature.

Referring to this state, Aitken observes: "A depression of the nervous state is very early manifested in the impaired energy of all the vital functions, the weakened condition of the intellectual faculties and *moral feelings*, and diminution of the general sensibility." As vital activity and mental power are simply the manifestation of consumption of material, and, unless the supply of that material in the shape of food is kept up, a progressive waste of both must necessarily ensue; and that which depends for its manifestation on the material—that is, food—must be the first to go, that being in this case the intellectual faculty—the power of distinguishing right from wrong.

An old writer (Guianerius) says, "Anchorites, monks, and the rest of that superstitious rank, through immoderate fasting, have been frequently mad," showing that even in early times the fact was known and believed that want of food perverted the higher attributes of the mind before it destroyed life.

What are the symptoms of death from want of food, and how long can man subsist without solid or liquid nourishment? According to the experiments of Chossat, death takes place in from eight to eleven days, and after forty per cent of the weight of the body is consumed. Now, as this means more of certain tissues than others, it may be interesting to mention those that suffer most. The fat wastes ninety-three per cent of its weight; the blood, seventy-five; the spleen, seventy-one; the liver, fifty-two; the heart, forty-four; the bowels, forty-two; and the muscles, forty-two. On the other hand, the following parts waste much less: thus, the bones waste sixteen per cent; the eyes, ten; the skin, thirty-three; the lungs, twenty-two; and the nervous system, i. e., the nerves, *only two per cent.* The point worthy of attention is the almost total consumption of fat

before death takes place; in fact, death by starvation is really death by cold. As soon as the fat of the body goes—and fat is the principle that keeps up the heat—death takes place; the temperature of the body diminishes but little until the fat is consumed, then it rapidly falls.

Chossat—whose experiments on dumb animals are most painful to read—is of opinion that death from exposure to intense cold and death from starvation are one and the same, as, in the torpor of death from want of food, the application of warmth to the body immediately restored consciousness, showing that heat is closely related to the principle of life, as manifested through the nervous system in its more subtile sense.

The symptoms of starvation from want of food are—severe pain at the pit of the stomach, which is relieved on pressure; this subsides after a day or two, but is succeeded by a feeling of weakness and "sinking" in the same region; then an insatiable thirst supervenes, which, if water be withheld, thenceforth becomes the most distressing symptom. The countenance becomes pale and cadaverous, the eyes acquire a peculiarly wild and glistening stare, and general emaciation soon manifests itself. The body then exhales a peculiar fœtor, and the skin is covered with a brownish, dirty-looking, and offensive secretion. The bodily strength rapidly declines; the sufferer totters in walking, his voice becomes weak, and he is incapable of the least exertion. The mental powers exhibit a similar prostration: at first, there is usually a state of stupidity, which gradually increases to imbecility, so that it is difficult to induce the sufferer to make any effort for his own benefit, and on this a state of maniacal delirium frequently supervenes.

Before death takes place the body appears to be undergoing putrefaction, so that, though it seems to waste in one way, the power of the system to eliminate the effete products is paralyzed, and these, instead of being burned off, as they are when the proper nourishment of the tissues is going on, remain and decompose; in no other way can the fœtor during life be accounted for, and the rapid decomposition after death. This accounts also for the fact that cholera, fever, and blood-poisoning are so much more fatal in the badly-fed than they are in the well-to-do; the low state of the vitality induced prevents the elimination of the poison, and the sufferer dies, not by the virulence of the disease, but by his inability, through weakness, to throw it off. Pestilential diseases always follow in the wake of famine, and destroy more than perish from actual starvation.

To show how long life may be carried on with a very little food, the following case may be interesting: In February, 1862, a man thirty-six years of age was discovered in a stack near Morpeth dying from starvation. All attempts to rally him failed, and he ultimately died. He was an intelligent man, and had been editor and proprietor

of a penny journal called the "Falkirk Liberal." A diary was found in his possession containing entries of his condition from February 8th to 25th, from which it appeared that during the *seventeen* days he had twice tasted a piece of bread, but that for the last *thirteen* days he had been entirely without food. During the first *ten* days of the *thirteen* he was able to obtain water, but on the *eleventh* day he found his legs were useless, and he lost all motive power in his lower extremities, so that half his body appeared to be dead.

There is also the well-known case of the fat pig that was buried in its sty under thirty feet of the chalk of Dover Cliff for one hundred and sixty days, and which was dug out alive at the end of that time, reduced in weight from one hundred and sixty pounds to forty pounds, or no less than seventy-five per cent ("Transactions of the Linnæan Society," vol. xi, p. 411). The extraordinary prolongation of life in this case may be attributed to the retention of the *heat* of the body by the non-conducting power of the chalk, and to the retention of its moisture by the saturation of the air in its immediate vicinity, and restriction of its movements.

As might be expected, the old can live longer without food than the young. In youth, the growth of the body causes more rapid consumption of nourishment, and the supply and the waste are more quickly got rid of; further than this, the nervous system, though more buoyant in youth, is less stable, so that the young perish quickly when the supply of food is cut off, from the want of sustaining power in the nervous system. This was illustrated in the recent case of cannibalism, the boy being in a dying state, when the men, so far as their muscular power was concerned, were strong enough to accomplish the terrible deed they did.

In the case of the Welsh fasting girl, death took place after deprivation of food for eight days. During the first few days she was cheerful, but later on it was found she could not be kept warm; she then lapsed into a state of torpor, from which she could not be roused, and died.

Four men and a boy were imprisoned in a mine from April 11th to April 19th; they had access to water, but no food, between those dates. When liberated, they all recovered; the damp atmosphere and their access to water being powerful factors in their aid.

Another curious fact to be observed in those who recover after prolonged starvation is their unwillingness to be questioned on the subject, and their inability to give any coherent version of their sufferings and feelings, showing plainly that the mental power was too torpid to take impressions at the time. In the recent case of cannibalism, their suffering was aggravated by intense thirst, but they seem to have been able to give a graphic account of the horrors of their situation, which is not usually the case.

The history of starvation points to this fact, that the moral sense

dies before the physical being; and some interesting intelligence may be gathered by a study of this subject in its broadest basis as a national question, where it relates to the intellectual and social qualities of race in ill-fed and well-fed countries.—*Health.*

THE CHEMISTRY OF COOKERY.

By W. MATTIEU WILLIAMS.

XL.—COUNT RUMFORD'S SUBSTITUTE FOR TEA.

TAKE eight parts by weight (say ounces) of meal (Rumford says "wheat or rye-meal" and I add, or oatmeal), and one part of butter. Melt the butter in a clean *iron* frying-pan, and when thus melted sprinkle the meal into it; stir the whole briskly with a broad wooden spoon or spatula till the butter has disappeared and the meal is of a uniform brown color like roasted coffee, great care being taken to prevent burning on the bottom of the pan. About half an ounce of this roasted meal boiled in a pint of water, and seasoned with salt, pepper, and vinegar, forms "burned soup," much used by the wood-cutters of Bavaria, who work in the mountains far away from any habitations. Their provisions for a week (the time they commonly remain in the mountains) consist of a large loaf of rye-bread (which, as it does not so soon grow dry and stale as wheaten bread, is always preferred to it); a linen bag, containing a small quantity of roasted meal, prepared as above; another small bag of salt, and a small wooden box containing some pounded black pepper; and sometimes, but not often, a small bottle of vinegar; but *black pepper* is an ingredient never omitted. The rye-bread, which eaten alone or with cold water would be very hard fare, is rendered palatable and satisfactory, Rumford thinks also more wholesome and nutritious, by the help of a bowl of hot soup, so easily prepared from the roasted meal. He tells us that this is not only used by the wood-cutters, but that it is also the common breakfast of the Bavarian peasant, and adds that "it is infinitely preferable, in all respects, to that most pernicious wash, *tea*, with which the lower classes of the inhabitants of Great Britain drench their stomachs and ruin their constitutions." He adds that, "when tea is taken with a sufficient quantity of sugar and good cream, and with a large quantity of bread-and-butter, or with toast and boiled eggs, and, above all, *when it is not drunk too hot*, it is certainly less unwholesome; but a simple infusion of this drug, drunk boiling hot, as the poor usually take it, is certainly a poison, which, though it is sometimes slow in its operation, never fails to produce fatal effects, even in the strongest constitutions, where the free use of it is continued for a considerable length of time."

This may appear to many a very strong condemnation of their favorite beverage; nevertheless, I am satisfied that it is perfectly sound. This is not an opinion hastily adopted, but a conclusion based upon many observations, extending over a long period of years, and confirmed by experiments made upon myself.

The "Pall Mall Gazette" of August 7th says, "There is balm for tea-drinkers in one of Mr. Mattieu Williams's 'Science Notes' in the 'Gentleman's Magazine.'" This is true to a certain extent. I referred to the Chinese as habitual drinkers of boiled water, and suggest that this may explain their comparative immunity from cholera, where all the other conditions for a raging epidemic are fulfilled. It is the boiling of the water, not the infusion of tea-leaves therein, to which I attribute the destruction of the germs of infection.

In the note which follows, I proposed an infusion of fried or toasted bread-crumbs, oatmeal, maize, wheat, barley, malt, etc., as a substitute for the tea, the deep color of the infusion (poured off from the grounds in this case) serving to certify the boiling of the water. Rumford's burned soup, taken habitually at breakfast or other meals, would answer the same purpose, with the further advantage to poor people of being, to a certain extent, a nutritious soup as well as a beverage. All that is nutritious in porter is in this, minus the alcoholic drug and its vile companion, the fusel-oil.

The experience of every confirmed tea-drinker, when soundly interpreted, supplies condemnation of the beverage; the plea commonly and blindly urged on its behalf being, when understood, an eloquent expression of such condemnation. "It is so refreshing"; "I am fit for nothing when tea-time comes round until I have had my tea, and then I am fit for anything." The "fit for nothing" state comes on at five P. M., when the drug is taken at the orthodox time, or even in the early morning, in the case of those who are accustomed to have a cup of tea brought to their bedside before rising. With blindness still more profound, some will plead for tea by telling that by its aid one can sit up all night long at brain-work without feeling sleepy, provided ample supplies of the infusion are taken from time to time.

It is unquestionably true that such may be done; that the tea-drinker is languid and weary at tea-time, whatever be the hour, and that the refreshment produced by "the cup that cheers" and is *said* not to inebriate, is almost instantaneous.

What is the true significance of these facts?

The refreshment is certainly not due to nutrition, not to the rebuilding of any worn-out or exhausted organic tissue. The total quantity of material conveyed from the tea-leaves into the water is ridiculously too small for the performance of any such nutritive function; and, besides this, the action is far too rapid, there is not sufficient time for the conversion of even that minute quantity into organized working tissue. The action can not be that of a food, but is purely

and simply that of a stimulating or irritant drug, acting directly and abnormally on the nervous system.

The five-o'clock lassitude and craving are neither more nor less than the reaction induced by the habitual abnormal stimulation; or otherwise, and quite fairly, stated, it is the outward symptom of a diseased condition of brain produced by the action of a drug; it may be but a mild form of disease, but it is truly a disease nevertheless.

The active principle which produces this result is the crystalline alkaloid, the *theine*, a compound belonging to the same class as strychnine and a number of similar vegetable poisons. These, when diluted, act medicinally, that is, produce disturbance of normal functions as the tea does, and, like theine, most of them act specially on the nervous system; when concentrated they are dreadful poisons, very small doses producing death.

The non-tea-drinker does not suffer any of these five-o'clock symptoms, and, if otherwise in sound health, remains in steady working condition until his day's work is ended and the time for rest and sleep arrives. But the habitual victim of any kind of drug or disturber of normal functions acquires a diseased condition, displayed by the loss of vitality or other deviation from normal condition, which is temporarily relieved by the usual dose of the drug, but only in such wise as to generate a renewed craving. I include in this general statement all the vice-drugs (to coin a general name), such as alcohol, opium, tobacco (whether smoked, chewed, or snuffed), arsenic, hasheesh, betel-nut, coca-leaf, thorn-apple, Siberian fungus, maté, etc., all of which are excessively "refreshing" to their victims, and of which the use may be, and has been, defended by the same arguments as those used by the advocates of habitual tea-drinking.

Speaking generally, the reaction or residual effect of these on the system is nearly the opposite of that of their immediate effect, and thus larger and larger doses are demanded to bring the system to its normal condition. The non-tea-drinker or moderate drinker is kept awake by a cup of tea or coffee taken late at night, while the hard drinker of these beverages scarcely feels any effect, especially if accustomed to take it at that time.

The practice of taking tea or coffee by students, in order to work at night, is downright madness, especially when preparing for an examination. More than half of the cases of break-down, loss of memory, fainting, etc., which occur during severe examinations, and far more frequently than is commonly known, are due to this.

I frequently hear of promising students who have thus failed; and, on inquiry, have learned—in almost every instance—that the victim has previously drugged himself with tea or coffee. Sleep is the rest of the brain; to rob the hard-worked brain of its necessary rest is cerebral suicide.

My old friend, the late Thomas Wright, was a victim of this ter-

rible folly. He undertook the translation of the "Life of Julius Cæsar," by Napoleon III, and to do it in a cruelly short time. He fulfilled his contract by sitting up several nights successively by the aid of strong tea or coffee (I forget which). I saw him shortly afterward. In a few weeks he had aged alarmingly, and become quite bald, his brain gave way and never recovered. There was but little difference between his age and mine, and but for this dreadful cerebral strain, rendered possible only by the alkaloid (for otherwise he would have fallen to sleep over his work, and thereby saved his life), he might still be amusing and instructing thousands of readers by fresh volumes of popularized archæological research.

I need scarcely add that all I have said above applies to coffee as to tea, though not so seriously *in this country*. The active alkaloid is the same in both, but tea contains weight for weight about three times as much as coffee. In this country we commonly use about fifty per cent more coffee than tea to each given measure of water, and thus get about half as much alkaloid. On the Continent they use about double our quantity (this is the true secret of "coffee as in France"), and thus produce as potent an infusion as our tea.

The above remarks are exclusively applied to the *habitual* use of these stimulants. As medicines, used occasionally and judiciously, they are invaluable, provided always that they are not used as ordinary beverages. In Italy, Greece, and some parts of the East, it is customary, when anybody feels ill, with indefinite symptoms, to send to the druggist for a dose of tea. From what I have seen of its action on non-tea-drinkers, it appears to be specially potent in arresting the premonitory symptoms of fever, the fever-headache, etc.

XLI.—AUTHORITIES ON TEA AND COFFEE.

Since the publication of my last I have been reminded of the high authorities who have defended the use of the alkaloids, and more particularly of Liebig's theory, or the theory commonly attributed to Liebig, but which is Lehmann's, published in Liebig's "Annalen," Volume LXXXVII, and adopted and advocated by Liebig with his usual ability.

Lehmann watched *for some weeks* the effects of coffee upon two persons in good health. He found that it retarded the waste of the tissues of the body, that the proportion of phosphoric acid and of urea excreted by the kidneys was diminished by the action of the coffee, the diet being in all other respects the same. Pure caffeine (which is the same as theine) produced a similar effect; the aromatic oil of the coffee, given separately, was found to exert stimulating effect on the nervous system.

Johnstone ("Chemistry of Common Life"), closely following Liebig, and referring to the researches of Lehmann, says: "The waste of the body is lessened by the introduction of theine into the stomach

—that is, by the use of tea. And, if the waste be lessened, the necessity for food to repair it will be lessened in an equal proportion. In other words, by the consumption of a certain quantity of tea, the health and strength of the body will be maintained in an equal degree upon a smaller quantity of ordinary food. Tea, therefore, saves food —stands to a certain extent in the place of food—while, at the same time, it soothes the body and enlivens the mind."

He proceeds to say that "in the old and infirm it serves also another purpose. In the life of most persons a period arrives when the stomach no longer digests enough of the ordinary elements of food to make up for the natural daily waste of the bodily substance. The size and weight of the body, therefore, begin to diminish more or less perceptibly. At this period tea comes in as a medicine to arrest the waste, to keep the body from falling away so fast, and thus to enable the less energetic powers of digestion still to supply as much as is needed to repair the wear and tear of the solid tissues." No wonder, therefore, says he, "that the aged female, who has barely enough income to buy what are called the common necessaries of life, should yet spend a portion of her small gains in purchasing her ounce of tea. She can live quite as well on less common food when she takes her tea along with it; while she feels lighter at the same time, more cheerful, and fitter for her work, because of the indulgence."

All this is based upon the researches of Lehmann and others, who measured the work of the vital furnace by the quantity of ashes produced—the urea and phosphoric acid excreted. But there is also another method of measuring the same, that of collecting the expired breath and determining the quantity of carbonic acid given off by combustion. This method is imperfect, inasmuch as it only measures a portion of the carbonic acid which is given off. The skin is also a respiratory organ, co-operating with the lungs in evolving carbonic acid.

Dr. Edward Smith adopted this method of measuring the respired carbonic acid. His results were first published in "The Philosophical Transactions" of 1859, and again in Chapter XXXV of his volume on "Food," "International Scientific Series."

After stating, in the latter, the details of the experiments, which include depth of respiration as well as amount of carbonic acid respired, he says: "Hence it was proved beyond all doubt that tea is a most powerful respiratory excitant. As it causes an evolution of carbon greatly beyond that which it supplies, it follows that it must powerfully promote those vital changes in food which ultimately produce the carbonic acid to be evolved. Instead, therefore, of supplying nutritive matter, it causes the assimilation and transformation of other foods."

Now, note the following practical conclusions, which I quote in Dr. Smith's own words, but take the liberty of rendering in italics those

passages that I wish the reader to specially compare with the preceding quotations from Johnstone: "In reference to nutrition, we may say that *tea increases waste*, since it promotes the transformation of food without supplying nutriment, and increases the loss of heat without supplying fuel, and *it is therefore especially adapted to the wants of those who usually eat too much*, and after a full meal, when the process of assimilation should be quickened, but *is less adapted to the poor and ill-fed*, and during fasting." He tells us very positively that "to take tea before a meal is as absurd as not to take it after a meal, unless the system be at all times replete with nutritive material." And, again, "Our experiments have sufficed to show how tea may be *injurious if taken with deficient food, and thereby exaggerate the evils of the poor*"; and, again: "The conclusions at which we arrived after our researches in 1858 were that tea should not be taken without food, unless after a full meal; or with insufficient food; or by the young or very feeble; and that *its essential action is to waste the system or consume food*, by promoting vital action which it does not support, and they have not been disproved by any subsequent scientific researches."

This final assertion may be true, and to those who "go in for the last thing out," the latest novelty or fashion in science, literature, and millinery, the absence of any refutation of later date is quite enough.

But how about the previous scientific researches of Lehmann, who, on all such subjects, is about the highest authority that can be quoted? His three volumes on "Physiological Chemistry," translated and republished by the Cavendish Society, stand pre-eminent as the best-written, most condensed, and complete work on the subject, and his original researches constitute a lifetime's work, not of mere random change-ringing among the elements of obscure and insignificant organic compounds, but of judiciously selected chemical work, having definite philosophical aims and objects.

It is evident from the passages I have emphatically quoted that Dr. Smith flatly contradicts Lehmann, and arrives at directly contradictory physiological results and practical inferences.

Are we, therefore, to conclude that he has blundered in his analysis, or that Lehmann has done so?

On carefully comparing the two sets of investigations, I conclude that there is no necessary contradiction *in the facts;* that both may be, and in all probability are, quite correct as regards their chemical results; but that Dr. Smith has only attacked half the problem, while Lehmann has grasped the whole.

All the popular stimulants, refreshing drugs, and "pick-me-ups" have two distinct and opposite actions — an immediate exaltation which lasts for a certain period, varying with the drug and the constitution of its victim, and a subsequent depression proportionate to the primary exaltation, but, as I believe, always exceeding it either in

duration or intensity, or both, thus giving as a net or mean result a loss of vitality.

Dr. Smith's experiments only measured a partial result (the carbonic acid exhaled from the lungs without that from the skin) *of the first stage*, the period of exaltation. His experiments were extended to 50 minutes, 71 minutes, 65 minutes, and in one case to 1 hour and 50 minutes. It is worthy of note that in Experiment 1 were 100 grains of black tea, which were given to two persons, and the time of the experiment was 50 and 71 minutes; the average increase was 71 and 68 cubic inches per minute, while in No. 6, with the same dose and the carbonic acid collected during 1 hour and 50 minutes, the average increase per minute was only 47·5 cubic inches. These indicate the decline of the exaltation, and the curves on his diagrams show the same. His coffee results were similar.

We all know that the "refreshing" action often extends over a considerable period. My own experiments on myself show that this is three or four hours, while that of beer or wine is less than one hour (moderate doses in each case).

I have tested this by walking measured distances after taking the stimulant and comparing with my walking powers when taking no other beverage than cold water. The duration of the tea stimulation has been also measured (painfully so) by the duration of sleeplessness when female seduction has led me to drink tea late in the evening. The duration of coffee about one third less than tea.

Lehmann's experiments, extending over weeks (days instead of minutes), measured the whole effect of the alkaloid and oil of the coffee, during both the periods of exaltation and depression, and therefore supplied a mean or total result which accords with ordinary every-day experience. It is well known that the pot of tea of the poor needle-woman subdues the natural craving for food; the habitual smoker claims the same merit for his pipe, and the chewer for his quid. Wonderful stories are told of the long abstinence of the drinkers of maté, chewers of betel-nut, Siberian fungus, coca-leaf, and pepper-wort, and the smokers and eaters of hasheesh, etc. Not only is the sense of hunger allayed, but less food is demanded for sustaining life.

It is a curious fact that similar effects should be produced and similar advantages claimed for the use of a drug which is totally different in its other chemical properties and relations. "White arsenic," or arsenious acid, is the oxide of a metal, and far as the poles asunder from the alkaloids, alcohols, and aromatic resins, in chemical classification. But it does check the waste of the tissues, and is eaten by the Styrians and others with physiological effects curiously resembling those of its chemical antipodeans above named. Foremost among these physiological effects is that of "making the food appear to go further."

It is strange that any physiologist should claim this diminution of the normal waste and renewal of tissue as a merit, seeing that life itself is the product of such change, and death the result of its cessation. But, in the eagerness that has been displayed to justify existing indulgences, this claim has been extensively made by men who ought to know better than admit such a plea.

I speak, of course, of the *habitual* use of such drugs, not of their occasional medicinal use. The waste of the body may be going on with killing rapidity, as in fever, and then such medicines may save life, provided always that the body has not become "tolerant" of or partially insensible to, them by daily usage. I once watched a dangerous case of typhoid fever. Acting under the instructions of skillful medical attendants, and aided by a clinical thermometer and a seconds-watch, I so applied small doses of brandy at short intervals as to keep down both pulse and temperature within the limits of fatal combustion. The patient had scarcely tasted alcohol before this, and therefore it exerted its maximum efficacy. I was surprised at the certain response of both pulse and temperature to this most valuable medicine and most pernicious beverage.

The argument that has been the most industriously urged in favor of all the vice-drugs, and each in its turn, is that miserable apology that has been made for every folly, every vice, every political abuse, every social crime (such as slavery, polygamy, etc.), when the time has arrived for reformation. I can not condescend to seriously argue against it, but merely state the fact that the widely diffused practice of using some kind of stimulating drug has been claimed as a sufficient proof of the necessity or advantage of such practice. I leave my readers to bestow on such a plea the treatment they may think it deserves. Those who believe that a rational being should have rational grounds for his conduct will treat this customary refuge of blind conservatism as I do.—*Knowledge.*

THE PERILS OF RAPID CIVILIZATION.

By CHARLES F. WITHINGTON, M. D.

THAT civilization exerts upon the older societies of the world an influence which is on the whole favorable to physical perfection and longevity has been abundantly shown. While certain forms of disease, more particularly those affecting the nervous system, are increasing in frequency as a result of the increased demands upon the workers in our large cities, yet there is no question that a more than countervailing influence is exerted by the greater knowledge of sanitary science and the increased resistant power which modern civiliza-

tion has conferred on mankind. The prolonged "expectation of life" which tables of life-insurance exhibit is of itself sufficient to demonstrate this fact; and much has been written to show in what the elements of this gain consist.

On the other hand, however, there is reason to believe that, for the newer races, the immediate effect of a contact with civilization has been disastrous. The rapid growth out from barbarism is not always a safe or a simple process. The birth of "a nation in a day" is not devoid of grave perils. A brief consideration of the physical effects of civilization upon primitive peoples is the object of this paper. First, as to the facts. There are upon our globe numerous barbarous and semi-barbarous tribes who have never come much in contact with the world's progress, and we have no reason to believe that these peoples are in any degree dying out. Nature keeps them, like the lower animals which the hunter has never molested, in full and probably somewhat increasing ranks. It is obvious that figures are very difficult to obtain regarding such races—almost as difficult as in respect to the dumb animals with which we have compared them. Both alike undergo reduction from the attacks of their natural enemies, and from famine, disease, flood, fire, and hurricane. Yet no general law of survival of the fittest sweeps these races entirely from the earth, or even greatly reduces their numbers. This law may and probably does have effect within the tribes themselves, bringing the strongest to the front and leaving the weakest in the rear, but it does not operate against the existence of the tribe as a whole so long as there is no contact or conflict with a superior race, any more than it operates against the increase of the human species as a whole. In China and Japan, almost alone of such peoples, we have means of judging of the population at different intervals; and, while there is room for doubt as to the absolute accuracy of the census, yet the figures are so numerous and the general tendency so uniform that it may be taken to show with certainty an increase within the last few centuries almost equal to that of England. For instance, we have statements of the population of China at many periods within the last five hundred years, in part from native and in part from European authorities, showing an increase of from eight to ten hundred per cent in the number of inhabitants.* This enormous gain has been in spite of many and terrible famines, of sanguinary wars, and of extensive infanticide. It is reasonable to suppose that in other lands, of which we have no figures to inform us, there has also been a like fertility, and that savages have a vigor of stock which has led to increase and multiplication on a scale not greatly different from that of our own race.

When, however, barbarous peoples come in contact with a higher civilization, they almost invariably undergo a decay pretty nearly

* See a list of various censuses in the "Journal of the Statistical Society," vol. xx, p. 51.

proportional to the intimacy of the contact, or rather to the readiness with which they endeavor to conform themselves to the manners of their new neighbors. Here is an important point. There is no mysterious influence, no "blight," caused by civilization. There is much loose talk about barbarians "melting away" before the light of progress. It may do for the poet to speak of the withering breath of civilization as blasting the child of Nature, but the real cause of the depressing effect of our civilization upon the savage lies in himself, and in his sudden attempt to assimilate what is foreign to the whole tenor of his personal habits, confirmed as they are by centuries of inherited experience. The instances, plentiful enough, of race-decay following civilization, are all in peoples in whom circumstances have led to a sudden and unnatural conformity with the manners of a stronger and more advanced nation. This has occurred generally where the savages have been brought in contact either with a conquering people or with missionaries, the latter cause operating for the most part only when the barbarous tribe was small and the Christianizing influence therefore especially strong, as in the Sandwich Islands. In one notable case the method of contact has been by the barbarians themselves becoming conquerors. Let us examine this latter instance first. The earliest authentic historical record of the Goths as a people shows them in the latter half of the third century living north of the Danube. For a hundred years they had very little connection with any more civilized nation. Then, on the appearance of the Huns in 376, a part of the nation (later to be known as the Visigoths) advanced south of the Danube, the eastern division of the tribe, or Ostrogoths, remaining on the northern side of the river, and mingling with the invading Huns. The latter portion, therefore, were not brought into connection with either branch of the Roman Empire, while the western Goths, gradually adopting a form of the Christian faith, and being enlisted in the Roman armies, were slowly being acted upon by southern civilization. Of course, the effect of the change was much less marked than that of the contact of barbarism with modern civilization; still, undoubtedly, a considerable modification of the character and customs of the western Goths was made, and it occurred gradually enough to diminish its shock. For many years they fought, alternately under and against the eagles, and when finally, under Alaric, their power became supreme in Italy, early in the fifth century, they retired into Gaul very soon after the first sack of Rome. Afterward, though they joined with the Italians against the combined forces of the Huns and Ostrogoths, yet their association was mostly with the provincial representatives of the Roman civilization, and they gradually assumed their permanent position in Aquitania and Spain, where they left their impress as a constituent part of the Provence nation.*

In marked contrast with this was the contact of the Ostrogoths

* Gibbon's "Decline and Fall," chapter xxxi, *et seq.*

with Roman civilization, it occurring more suddenly and lasting longer. Joined in fortunes with the Huns, they shared in the terrific defeat of Attila at Châlons in 451. At just about this time Theodoric, destined to become their great leader, was born. Brought up at Constantinople, as a hostage, he was imbued with the best culture of the Eastern Empire. In 489 he led his people into Italy, and, overcoming the resistance of a usurping king, speedily made himself master of that country. Two hundred thousand men, with their wives and children, were settled in Italy. For thirty-three years they mingled as conquerors in the current of a new and untried civilization. They conformed themselves to the Roman administration and policy. So far from destroying the monuments of art, they took measures for their restoration and preservation. Agriculture and the arts of peace revived, and Italy almost regained the prosperity of her palmiest days. The "barbarian" set himself and his soldiers to do police duty for the Roman officers of law and government, who were retained in their titles and functions. An Arian himself, he respected and tolerated the Catholic faith.* In fact, we have here a most marked instance of a people in the position of conquerors adopting, in a generation, the civilization of their vanquished foes. And what is the result? Their wise and beneficent king died in 526. In the next twenty-five years the prosperous and strong nation rapidly declines in power and numbers. Belisarius and his successor Narses overcome them, now by strategy, now by force, until, in 553, their last king is slain, and the nation of the Ostrogoths becomes extinct.†

We can only allude, in passing, to the Huns, who never fairly reached the seat of the Roman power in Italy, though they were sought in alliance by the timorous emperors—and it is remarkable, in view of their vast numbers, how completely they disappear from history, within twenty years of their first aggressions on Roman territory, in the defeat and death of their one great chief.

The Vandals demand a word of attention. Though they appear in history as early as the second century, they are peaceably disposed of and remain quiet in Pannonia till the beginning of the fifth century, when they attack Gaul; thence they overrun Spain, to be displaced by the western Goths, and cross to Africa. Each of the barbarian races seems to have had its one great man, and the Vandals had their Genseric. In Africa they numbered from fifty thousand to eighty thousand men, and took their turn at sacking the Imperial City. For fourteen days they ravaged it. But it was only a foray, not a conquest. They did not stay among the Italians, as the Ostrogoths had done. Early in the following century Belisarius had slain their last king. A few of their soldiers were enlisted to fight in the Persian wars, but the sacrifice of these is, in the words of Gibbon, "insufficient to explain the fate of a nation whose numbers, before a short and

* *Vide* Gibbon, chapter xxxix. † Ibid., chapter xliii.

bloodless war, amounted to more than six hundred thousand persons." *

All these races, except the Huns, were of Teutonic or kindred lineage. What we wish particularly to call attention to is, that while they, powerful in numbers, vigorous in body, and indomitable in spirit, under the influence of the old civilization of the South speedily became extinct as races, and, except in the single case of the Visigoths, even left no visible impress of themselves upon a subsequent people, while, in fact, they dropped out of existence; yet, on the other hand, similar nations, coming also from Northern Europe, of the Teutonic family, driven by the same impulse for adventure and conquest, but going instead among the barbarous Britons, with whom they were amalgamated, became, by a slow, a natural process of evolution, the foremost nation of the globe.

These instances from antiquity are sufficiently striking. But it is in modern times only that we can really study to advantage the effect of a sudden civilization upon barbarians. In the cases thus far considered we can judge of effects only when they are extreme, as leading to the extinction of a race. There is no means of estimating those lesser changes which are best measured by the aid of the census. Nor is it possible at this distance of time to appreciate fully those different elements of deterioration which can be observed in contemporary races. Hence we pass to some of the more recent illustrations of the point under discussion.

The present century has witnessed in the Sandwich Islands what is probably the most remarkable instance of civilization in the history of the world. A little more than one hundred years ago Captain Cook was killed by the natives, who, though not cannibals, were as degraded as any tribe on the face of the earth. The story of this people is too familiar to need repetition. The first missionary visited the islands in 1820. In 1853, just one generation later, the American Board of Foreign Missions declared that the people were Christianized, and withdrew its support from the churches. Since that time they have not only maintained themselves, but are supporting missionaries in Polynesia. The formation of a constitutional government, the negotiation of treaties, the development of a system of education, the grateful and graceful contributions made in aid of the United States Government during our late civil war, all have happened within the memory of middle-aged men. Mr. Charles Nordhoff, who is certainly not prejudiced in favor of the missionaries, says † that they "have eradicated the grosser crimes of murder and theft so completely that . . . people leave their houses open all day and unlocked all night, without thought of theft; and there is not a country in the world where the stranger may travel in such absolute safety as in these islands. In 1880 there were two

* *Loc. cit.*, chapter xli.

† "Northern California, Oregon, and the Sandwich Islands," p. 24.

hundred and ten schools, having an attendance of over seven thousand children." Even in 1873 Mr. Nordhoff said, "The natives of these islands are, there is reason to believe, the most generally educated people in the world." Yet, with the phenomenal advance in intellect and morals which this race has made, there is a most rapid and melancholy decay of their physical organization. With an abundance of schools and churches, there are every year fewer scholars and worshipers; with an admirable system of government, there are constantly becoming fewer to govern.

The successive census returns tell this sad story: In 1832 the inhabitants of the islands were 130,313; in 1836, 108,579; in 1850, 84,165; in 1860, 69,700; in 1866, 62,959; in 1872, 56,897; in 1878, 57,985.* And even this seeming arrest, shown by the last census, in the process of decay in the native race, is not real; for during the last six years the Hawaiian population decreased over four thousand, the total gain being caused by an increase of foreigners to the extent of over five thousand. The Government, in a frantic effort to save itself from extinction, is importing immigrants: during the two years ending in 1880 it introduced over nine hundred Portuguese from the Madeira Islands, and more than eleven hundred Polynesians from the Gilbert Islands. Besides these, many Chinese have come. We are told, moreover, that the physical type of the natives has deteriorated; that the great stature and forms noted by the early visitors to the islands have passed away.

The history of the Hawaiians for the last sixty years might be almost condensed into three words—Christianization, civilization, extermination.

In 1860 Mr. F. D. Fenton was instructed by the New Zealand Government to prepare a statement with reference to the decay of the aboriginal Maori race, together with an investigation into its causes. His report, which is contained in Volume XXIII of the "Journal of the Statistical Society," shows a marked decrease, amounting to nineteen and a half per cent in the fourteen years from 1844 to 1858. This loss of numbers occurred in the absence of most of the causes commonly assigned for the decay of races. Mr. Fenton shows that all the tribes occupied healthful situations, that the climate was benign, and that the fertility of the soil was such as to secure an abundance of nutritious food. In fact, while the United States was increasing at the rate of thirty-five per cent every decade, this ancient race was diminishing at the rate of fourteen per cent every ten years; and, so far as the natural advantages of soil and climate are concerned, there seems to be little to choose between the two countries. Moreover, this deterioration was of recent origin. It was first noticed in 1841 by Bishop Broughton, and the Maories themselves say that it has commenced within the recollection of the present generation. The fact that there are more males

* Mrs. Judd, "Honolulu," *vide* Appendix, by Albert Judd.

than females disposes of the theory that war is the cause of the decrease; and infanticide, which chiefly affected the females, has ceased since 1836. Small-pox has now visited the island; measles may be said to be the only epidemic disease brought by the Europeans, and this did not appear till 1853. There is very little intoxication, and the "vice-diseases" are said to take a very mild type. Finally, that some radical cause is in operation is shown by the fact that actually fewer children are born than before the colonization of the island, and that, while the half-breed families are large, the native families are small, and the infantile mortality is very great. In view of the wide extent of country over which this process is going on, the author sees nothing to expect but the speedy extinction of the race.

The history of the American Indians should obviously not be omitted in this consideration. Unfortunately, figures here are unreliable. Estimate necessarily replaced enumeration regarding the aboriginal population when the whites landed, and has continued in large degree to do so since. Doubtless terror and perhaps vain-glory added something to the report of the numbers of the savages whom our ancestors fought and vanquished. But we have some ground for a comparative estimate of the native population. In 1822 a census was taken by the Government of the Indians east of the Mississippi, with reference to the removal of them which was then contemplated. According to this enumeration, they were 120,000. Bancroft's estimate of the Eastern Indians in the first half of the seventeenth century is 180,000. This would indicate a diminution of thirty-three per cent in two centuries, during which the Indians had been more or less in contact with the whites, and during the latter part of which they had doubtless begun to modify their way of living in accordance with the customs of their neighbors. It was about this time that the policy of removal to reservations beyond the Mississippi was inaugurated. A few of the Cherokees had accepted a reservation in Arkansas in 1817, but it was not till 1828 that the majority of them left Georgia, and the emigration continued through the following ten years. In 1838, 81,000 had been removed, 39,000 remaining east of the Mississippi.* In 1853 only 18,000 remained in their original locality, and 60,000 out of a total of 90,000 removed Indians had been settled in the Indian Territory.

Now, according to the report of the Indian Commissioner for 1879, the population of the five so-called civilized tribes in that Territory, viz., the Cherokees, Choctaws, Chickasaws, Creeks, and Seminoles, was 60,000; and the remaining reservations in the same Territory, some six or seven in number, include several thousands, so that the civilized tribes must have undergone considerable increase. Colonel Otis estimates that the Cherokee tribe has doubled in the last century.† He

* *Vide* "The Indian Question," by Elwell S. Otis, lieutenant-colonel United States Army, chapter i.

† Ibid., p. 44.

believes that some 10,000 or more of the tribe are elsewhere than in the Indian Territory, making 30,000 in all, and cites an enumeration by the War Department in 1827, preparatory to their removal, showing 13,567 individuals at that time. If we do not accept the view of an increase of one hundred per cent in a hundred years, we must at least concede a gain of fifty per cent in the last fifty years, and it is probable that the increase has occurred mainly in that time. The same authority says the Creeks, Choctaws, and Chickasaws are increasing in numbers. The fifth tribe, the Seminoles, who, after our war with them, in 1842, were reduced to three hundred, now number 2,560.* The "Six Nations," who remained by preference in New York, rather than migrate, are of course under circumstances permitting an accurate census, and their numbers seem to remain constant at about 7,000.

The remainder of the tribes are decreasing in numbers. This can not be doubted. The figures of the Government reports of the aggregate Indian population within the last fifty years are as follows: 1822, 457,000; 1830, 313,000; 1840, 400,000; 1855, 350,000; 1872, 300,000; 1879, 252,897. Even if we were to admit with Colonel Otis that such enumerations are vague and unreliable, and that the aggregate number of Indians remains about the same that it has been for the past two centuries, the increase of the civilized tribes necessarily implies the decrease of the remainder to keep the total unchanged.

The same thing is shown directly by the history of such of the uncivilized tribes as by reason of fortuitous historical associations have been brought under special observation. For instance, the Delaware Indians, made famous by Penn's negotiations with them, were, two hundred and fifty years ago, undoubtedly a large and powerful tribe, occupying much of the present States of Pennsylvania (Central) and New Jersey. In 1763 they had six hundred warriors, and it was even proposed to organize this tribe into a fourteenth State of the American Confederation, in 1778. After the Revolution, they removed to Ohio, then to Missouri, then to Kansas, then to the Cherokee country. Now the remains of the tribe in the Indian Territory number only about a thousand. The history of the Pueblo tribes confirms the same view. In 1540 the Spanish explorers found these people as a large and flourishing kingdom. Even making the great allowance which modern investigation seems to show necessary for the exaggeration of the Spaniards as to the power and wealth of the aborigines, even admitting that there was never any Aztec or Maya empire,† and that what did exist was only a military democracy or league of free tribes, it can not be doubted that the tribes were of great strength and importance. The ruined Pueblos themselves bear witness to this. In fact, it is only twelve years ago (1872) since a census showed these Indians as num-

* Report of the Indian Commissioner, 1879.

† *Vide* T. W. Higginson, in "Harper's Monthly Magazine," August, 1882; also, Lewis H. Morgan, in the "North American Review," April, 1876.

bering 7,683. Yet now the Zuñis, made familiar to all by Mr. Cushing's recent residence among them, are almost the sole survivors of that ancient race, and they number only about sixteen hundred persons. And, what is especially to the purpose of the present discussion, this tribe was of all the most isolated, and the least contaminated by either Spanish or Anglo-American civilization; all the other (river) Pueblos, now practically extinct, having been brought more into contact with the influence of the whites.* What civilization the Zuñis have (if indeed that term can be used at all where there is no written language), the agriculture, the manufacture of pottery and blankets, are wholly historic in origin, this conservative people never having borrowed anything from the Anglo-Saxon or any other race.

From this brief view of the Indian population we must conclude that, so far from its being on the increase as a whole, as some recent writers have claimed, the gain is entirely confined to those few tribes which deserve in a great degree the epithet commonly applied to them, of the "civilized Indians." Taking the Cherokees as representatives of these tribes, we find that they have been under missionary influence for two hundred and fifty years, and that there were eight thousand religious converts among them so long ago as 1700. The traveler Bartram,† writing about 1762, said of them: "They are just, honest, liberal, and hospitable to strangers; considerate, loving, and affectionate to their wives and relations; fond of their children, industrious, frugal, temperate, and persevering, charitable and forbearing." He speaks, moreover, of their wearing woven fabrics, of their police arrangements, their domestic economy, and particularly of their marked loyalty to the dictates of conscience. The Cherokees, then, had fairly entered on the path of progress a hundred and twenty years ago. To-day they possess sufficient property, if equally divided, to give each man, woman, and child, a thousand dollars. Their school expense amounts to thirty-five dollars annually per scholar, a sum greater than that similarly expended, even in our great center of philosophy. The proportion of illiteracy is smaller than that throughout the United States. "Their condition is far better than that of the agricultural classes of England."‡ The five civilized tribes have, on the average, a house for every three or four persons, and one hundred and ninety-five schools and one hundred and thirty-one church edifices for the population of sixty thousand individuals.*

In view, then, of the time spent and the result reached, we may consider that those tribes which are increasing in numbers have passed through their period of acclimation, and we may still believe that the

* *Vide* "The Last of the Pueblos," "Harper's Monthly," June, 1882.

† *Vide* note to the journal of Father Charlevoix, "Historical Collections of Louisiana," vol. iii, p. 130.

‡ "The Indian Question," by Francis A. Walker, p. 57.

* *Vide* report of the Indian Commissioner for 1879.

law of arrest, exemplified in the early history of the Cherokees, is now in operation in the majority of the Indian tribes, as in all other peoples exposed to the sudden contact of a new culture. A late Commissioner of Indian affairs* says, "Indian blood, thus far in the history of this country, has tended decidedly toward extinction." And the most recent writer on the Indian question tells us that wherever civilization is attempted among those people "the results are at first discouraging, with increased mortality and disease."†

These three races, the Hawaiian, the Maori, and the American, have been selected as the best instances of the adoption of a civilization involving complete and radical changes in mental, moral, and physical circumstances, made with some spontaneity, perhaps, in a few cases, but still essentially alien from the natural tendencies of the people, and devoid of that great safeguard of gradualness which Nature, when left to herself, throws about that critical process. In these peoples the exposure to the new leaven has been most sudden and most complete. We may allude, however, in passing, to some of the less perfect illustrations of the same process. The African negro has been in contact with the whites nearly as long as the Indian, but under circumstances widely different. Up to twenty years ago he was sedulously kept from becoming civilized. It was the express aim of his masters to repress his intellectual nature as completely as possible. The effect of his enslavement, then, was not to civilize him in any sense, but merely to change him from a wild animal into a domesticated or "tame" one. Since the war, his condition as a whole, in the South, has not materially changed in this respect. Of course, now and then an individual has emerged into an intellectual consciousness, and has become an intelligent and civilized member of society. But the great multitude, ignorant, improvident, lazy, have undergone no sufficient change in their natural way of living to disturb their physical equipoise, and with food enough to keep their bodies well nourished, and with scarcely a conscious nervous system, they increase and multiply faster than our white population.‡

Japan is a country which has undergone a most remarkable and sudden mental awakening. But here we are deterred by two facts from tracing any effect upon the stability of the physical organization of the people. In the first place, the intellectual development has not permeated the whole social structure. Only a small class have as yet felt it. In the second place, the movement is so recent, beginning since the revolution of 1868, that sufficient time has not elapsed for it

* General Walker, *loc. cit.*, p. 54.

† "The Red Man and the White Man in America," George E. Ellis, p. 624.

‡ The census returns of the colored population are in round numbers as follows, for the successive decades of this century: 1810, 1,191,000; 1820, 1,538,000; 1830, 2,009,000; 1840, 2,487,000; 1850, 3,254,313; 1860, 8,954,000; 1870, 4,880,000; 1880, 6,581,000.

to show an effect upon the bodily condition even of those whom it has affected.

If, as appears to be the case, a markedly increased mortality attends upon the rapid civilization of a race, to what are we to ascribe it? Obviously, not to the same influences which, in a cultivated nation, we have found to be sources of physical weakness. For in the latter case the factors are such as have acted through several generations; while in the former they are expended most strongly on the generation upon which the sudden change of *régime* has fallen, and which has not yet had time to develop (for instance) a neuropathic tendency. In considering some of the additional and peculiar elements operating in these peoples, we may say, first, that the diminished number and vigor of the population are in some degree a temporary result of the sudden abolition of polygamy. It is true that observation shows clearly that monogamous parents propagate a more vigorous and on the whole a more numerous race than polygamous ones. In the latter case more children are born, but much fewer grow up, and those who do attain years of manhood are less virile than in nations where the unions are single.* An Oriental gentleman remarked to a European traveler that by his various wives he had had sixty children born to him, but that only seven had lived to grow up. This may perhaps be taken as a fair indication of the results of such unions. But, while polygamy is as debasing to the physical as to the moral nature, it is entirely possible that the primary effect of a sudden abolition of multiple marriages may be a reduction in the birth-rate, while the children that are born do not as yet participate in the physical benefits which, after two or three generations, will follow the improved marital relation.

Again, we have to consider the so-called "vices of civilization"—a term which, in itself, involves a contradiction. Properly speaking, the alcohol and opium habits, and other diseases (not to be here mentioned), form no part of civilization. There should be no connection between it and any *vice*. The word, in its true and original meaning, signifies a fault, an abnormality. Surely, the blemish which occurs on any growth is not to be fairly reckoned as a part of that growth. Civilization is not responsible for its so-called vices. Yet the fact is indisputable that these evil habits and passions are, as it were, beasts of prey, skulking along the march of progress, seizing upon those who fail or falter by the way, and indeed finding their victims among all but the best-disciplined and the most steadfast of the host. They do not belong to civilization, but they invariably attend upon it; and the people along the line of progress are, until they become firmly incorporated in the moving column, especially subject to becoming the prey of those hyenas.

The most frequent agent which establishes connection between

* *Vide* "Journal of the Statistical Society," vol. xxviii, p. 271.

civilized and barbarous peoples is trade. Even when the initial move has been made by the missionary, the trader, scenting the chance for gain, is not slow to follow. In this way one of the earliest forces brought to bear upon the barbarian is that of the sailor and the trader. Unfortunately, there is hardly a class of Anglo-European society whose moral influence is so bad as that of the seamen. The trader sends those commodities which will prove most attractive to the barbarian; and the latter, with his moral nature as yet uneducated, and his power of self-denial undeveloped, is impelled toward the grossest pleasures of intemperance and licentiousness. Even if he only exchange his native indulgences for those brought by the white traders, the effect is most disastrous. The raw American whisky does its deadly work faster than his own "palmy wine."

The policy of the trader finds a response in the attraction of the untutored mind toward the new indulgence; and, too often, the preaching of the missionary is more than offset by the practices of the money-seeking trader who has come in the same ship with him. Yet this, it should be remembered, is only incidental. Civilization is to the savage what education is to the child, and one of its objects, attainable perhaps not in one or two generations, is to teach him self-restraint. It certainly is not responsible for his failures in that quality.*

The positive influences which are for a time deleterious to a people in process of civilization are probably much more physical than mental. The mind is not sufficiently taxed to create any disturbance in the economy; and the history of the Indian children who have been brought to the schools at Hampton and Carlisle for education does not show any evil consequences to their health from the intellectual impetus given them, they being selected from tribes where the physical condition, food, clothing, etc., were already approximated to the usages of the whites.

Probably no single influence has had so deleterious an effect upon the physique of the rapidly civilized peoples as *clothing*. Of course, no one will deny Carlyle's doctrine that man is essentially a clothes-wearing animal, and that dress is absolutely necessary in a cultivated community. The climatic conditions of many denizens of the tropics do not require clothing as a matter of protection or comfort, and consequently they do not wear it to any extent. When civilization reaches those people it says, "You must be dressed." Indeed, too often a European or a New England culture says, "You must be dressed in

* We may quote in this connection the words of Morel ("Traité des dégénérescences, physiques, intellectuelles, et morales, de l'espèce humaine," p. 494): "For limited societies, like the indigenous tribes which still exist in America, for other societies even more numerous, that have yet only passed through the period of infancy, which is that of desire, the contact of civilization is a fatal thing—when, instead of the moral law of which it ought to be the harbinger, civilization only brings to them the means of satisfying their grosser appetites as well as the bad tendencies, fruit of the complete lack of instruction, either acquired or inherited."

European or in New England fashion." This is only one phase of a wide-spread and mischievous tendency to impose the particular habits of the new teachers, as being an essential element in race-development, without regard to the natural leanings of the people in question. Many of our customs are purely arbitrary, and it is worse than folly to attempt to impose them upon a new-found race. The civilization of New England is undoubtedly an admirable one, but why insist on making New-Englanders out of Hottentots? Educate them, Christianize them, but do not oblige them to conform to customs which are the accident of another climate and another race. In nothing is this disposition to enforce conformity with an arbitrary standard more injurious and yet more absurd than in the matter of clothes. It would be hard to maintain that the frock-coat or the linen shirt-front of the present representatives of the Anglo-Saxon race are either graceful in the abstract or especially adapted to the use and comfort even of their wearers. Why, then, impose them upon the Sandwich-Islander, or why make them a test of the civilization of the American Indian, by classifying the tribes into the savages and those that wear "citizens' clothes"? We affirm with all seriousness that there is no reason why the inhabitant of the tropics should be expected to wear clothing in form or material like what happens to be in vogue among the dwellers in the temperate zone on the other side of the globe. The grotesque combinations in the habiliments of the Hawaiians, as described by Mark Twain, are as painful to the reason as they are ludicrous to the imagination. Why, for example, need the good missionary women have exerted themselves to make a broadcloth coat for the king of the islands? It and what it represented have been a fruitful source of disease and death to the simple people of that balmy summer clime.

But we may go a step further, and declare that even if a wise liberality allows the savage to dress somewhat in accordance with the requirements of his climate and his pursuits, there yet remains a certain conflict between the minimum demands of civilization in this respect and his bodily welfare, at least until he and his descendants become educated into a tolerance of the new requirement, dress. Consider that we are supposing the case of a dweller in the tropics, where, as a matter of protection, clothing is not required. The temperature is for the most part balmy, and, when it does grow colder, that wonderful mechanism whereby the body is protected from the changes in the surrounding medium does its perfect work. The skin, shiny, tough, and hardy, performs its function well, and "catching cold" is a rare thing. The man, *as an animal*, has no more need of clothing than the beasts around him. But, when he becomes civilized, this must all change. His smooth, dark skin must be covered. Decency and the laws of society require it. It is inevitable, so soon as he begins to be anything more than an animal. What happens? That skin, shut in from the sun and air, loses its quick power of accommodation. Its

natural moisture is not allowed to dry. The man is in an atmosphere, now hot and moist, now cold and moist. His clothing can not adjust itself to the changes of temperature so well as his skin once could. He gets wet in a rain, and is chilled by the drenched clothing which does not dry as his skin would have done. He begins to experience the phenomenon of taking cold. The multiform ailments which thus originate begin to beset him. The lungs especially are apt to suffer, and his health is seriously broken. Once he had a thick skin, the perfect clothing which Nature gives her animals. Now, a thinner, more sensitive one grows under the habiliments that mark the new social order. This is not merely theory. The New-Zealanders themselves ascribe their physical decay in part to their assumption of clothing.* Mr. Nordhoff, in his book on the Sandwich Islands, also alludes to this as one possible cause of the decay of that people. In the case of the African slaves the element of clothing is of less consequence. For here the people have been removed from their native climate to one which necessitates some clothing on grounds of actual comfort. Morover, they were not as a rule obliged to wear more than the real demands of the climate required; so that there was not even a temporary decrease of their numbers from this cause. But in tropical peoples, and in all others where the innovation in the matter of dress is independent of any real physical requirements, theory and fact agree in ascribing a malign influence to the change. In the ancient myth, Hercules untiringly endured his mighty labors, and was victorious in all his sturdy conflicts with opposing forces; but, at last, the poisoned robe of Nessus brought him to his death. So to many a child of Nature has the garb of civilization proved an envenomed mantle, consuming its wearer.

Closely connected with the subject of clothing is that of food; for physiology shows us a reciprocal relation between them. The life of a starving animal can be prolonged by retaining his warmth, or, in other words, by clothing him; and, conversely, an increase of clothing diminishes the consumption of food. When our newly civilized barbarian puts on clothing which the temperature of his climate does not require, he must lower his diet in a corresponding degree. The extent of this influence may be appreciated from a brief view of the physiology of nutrition. The non-nitrogenous articles of food and the non-nitrogenous modicum which remains after the splitting up of the nitrogenous (proteid) foods furnish the energy of the body. This is estimated in the average man at one million metre-kilogrammes daily; the force required to raise one kilogramme in weight one metre in height being the unit of force. Now, of this force, 150,000 metre-kilogrammes are expended in muscular work, and the remainder, four fifths or more, are required to maintain the animal heat. But three fourths of the entire heat expenditure is made by radiation and con-

* *Vide* F. D. Fenton, *loc. cit.*, "Journal of the Statistical Society," pp. 524, 529.

duction from the surface of the body.* Of course, the adoption of clothing does not prevent the whole of this radiation of heat. But it does affect most strongly the one strongest factor in the demand for food. It relieves to a considerable extent an expenditure which has required for its maintenance at least three fifths of the whole food-consumption of the body. This sudden and remarkable curtailment in the alimentation of the individual can but produce a profound effect upon the whole nutrient apparatus of the body. Or, if, escaping this danger, the individual does not lessen his diet to correspond to the new scale of requirements, he is exposed to the perils of overfeeding, because he is taking an amount of food which has now become largely in excess of his necessities. Moreover, the risks from quantity of food are enhanced by others from its quality. The new civilization brings new kinds of food. Meat-eating is encouraged as being in accord with the usages of temperate climes, without regard to what the requirements of the tropical animal may be. With the new kinds of food comes new cooking. Rational cooking is not a characteristic of early periods of civilization, or of frontier methods; and irrational cooking—always harmful—is particularly so to those who have never been hardened to it. And so it comes to pass that the frying-pan is added to the dangerous weapons put by civilization into the savage's hand.

Connected with these agencies, but more especially operative among the more northern peoples, as for instance the American Indians, are the influences of ill-ventilated and improperly heated dwellings. Ventilation and domestic sanitation are among the most recent of sciences, and even in the oldest centers of civilization are only just beginning to be given the consideration due to their importance. What wonder, then, that the Indian, accustomed to the airiness of a loosely built wigwam or a hut of boughs, should find, in the closely joined cabin that the white man teaches him to build, a source of foul and poisoned air to which his previous wild life makes him especially sensitive? Between the Scylla of carbonic-acid gas and animal effluvia and the Charybdis of cold draughts the savage steers a troublous course in the early years of his living under his "own roof." And, if, perchance, the trader has sold him an "air-tight stove" as a substitute for his former camp-fire, his perils truly thicken.

Finally, we must not omit to mention the moral and psychical influences which, though not tangible, are nevertheless powerful, and whose effect in the very awakening of a people is not altogether favorable to a calm and healthy life. There is a sudden disturbance of the mental equipoise by the introduction of new wants and new aims. A savage once brought directly into the current of the activities of civilization can never be again just what he was. An undefined but powerful desire and unrest have taken possession of him. When once the note of progress has sounded in a people's ears, its echoes do not easily

* *Vide* Foster's "Physiology," p. 323, *et seq.*

die out. Tecumseh struggled in vain against this impelling force, and pleaded that his people might be suffered to be as they were, but in vain.

The new leaven has been deposited, and its working is inevitable. Men say: "Let the savage alone; do not try to teach him civilization; he is happier in the state of nature than he can be in any that is more artificial"—and perhaps they tell the truth. It is a thorny path—this of progress—and the first step costs the most. We may even admit, with a recent distinguished sympathizer in the retrogressive leanings toward the simplicity of savagedom: "It is the direct tendency of our civilization to carry human beings toward an extreme as far beyond the simple elements of happiness and every form of good as savage life falls short of them." *

Doubtless, development increases the capacity both for enjoyment and for suffering. And if it be questioned whether joy or sorrow predominates in the experiences of our highest civilization, it may well be doubted whether, in the first awakenings of a people, when the power of judging between good and evil has not yet been formed, and when self-control is as yet unknown, the evil influences do not outweigh the good. Left to himself, the child in his early gropings gets many a bruise, many a tumble; yet, once having breathed the breath of life, the infant race is thenceforward impelled by a law inexorable as human destiny. If, as some advise, we abandon these people, and say: "We will not help you along a path which is one of toil and unrest; be as you were," they will not, it is true, progress in any orderly or efficient manner, but *they will not be as they once were.* We can guide them, or we can leave them to the painful and disordered action of their own struggling spirits. They can not return to their former quiet and contented sphere. Restlessness is an essential antecedent to progress; but restlessness implies conflict and labor. It is something higher than purposeless repose; but it is something harder. Of old it was said to the woman, "In sorrow shalt thou bring forth children"; and, by a law as universal, the birth of mind, in nations as well as in individuals, is not without a pang.

RELIGION AND THE DOCTRINE OF EVOLUTION.†

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THE regularity of nature is the first postulate of Science; but it requires the very slightest observation to show us that, along with this regularity, there exists a vast irregularity, which Science can only deal with by exclusion from its province. The world as we see

* Dr. George E. Ellis, *loc. cit.*, p. 597.

† Abstracted from "The Relations between Religion and Science," by the Lord Bishop of Exeter.

it is full of changes; and these changes, when patiently and perseveringly examined, are found to be subject to invariable, or almost invariable, laws. But the things themselves which thus change are as multifarious as the changes which they undergo. They vary infinitely in quantity, in qualities, in arrangement throughout space, possibly in arrangement throughout time. Take a single substance such, say, as gold. How much gold there is in the whole universe, and where it is situated, we not only have no knowledge, but can hardly be said to be on the way to have knowledge. Why its qualities are what they are, and why it alone possesses all these qualities; how long it has existed, and how long it will continue to exist, these questions we are unable to answer. The existence of the many forms of matter, the properties of each form, the distribution of each: all this Science must in the last resort assume.

But I say in the last resort. For it is possible, and Science soon makes it evident that it is true, that some forms of matter grow out of other forms. There are endless combinations. And the growth of new out of old forms is of necessity a sequence, and falls under the law of invariability of sequences, and becomes the subject-matter of science. As in each separate case Science asserts each event of to-day to have followed by a law of invariable sequence on the events of yesterday; the earth has reached the precise point in its orbit now which was determined by the law of gravitation as applied to its motion at the point which it reached a moment ago; the weather of the present hour has come by meteorological laws out of the weather of the last hour; the crops and the flocks now found on the surface of the habitable earth are the necessary outcome of preceding harvests and preceding flocks, and of all that has been done to maintain and increase them; so, too, if we look at the universe as a whole, the present condition of that whole is, if the scientific postulate of invariable sequence be admitted, and in as far as it is admitted, the necessary outcome of its former condition; and all the various forms of matter, whether living or inanimate, must, for the same reason and with the same limitation, be the necessary outcome of preceding forms of matter. This is the foundation of the doctrine of evolution.

Now, stated in this abstract form, this doctrine will be, and indeed if science be admitted at all must be, accepted by everybody. Even the Roman Church, which holds that God is perpetually interfering with the course of nature, either in the interests of religious truth or out of loving-kindness to his creatures, yet will acknowledge that the number of such interferences almost disappears in comparison of the countless millions of instances in which there is no reason to believe in any interference at all. And, if we look at the universe as a whole, the general proposition as stated above is quite unaffected by the infinitesimal exception which is to be made by a believer in frequent miracles. But when this proposition is applied in detail it at once

introduces the possibility of an entirely new history of the material universe. For this universe, as we see it, is almost entirely made up of composite and not of simple substances. We have been able to analyze all the substances that we know into a comparatively small number of simple elements—some usually solid, some liquid, some gaseous. But these simple elements are rarely found uncombined with others; most of those which we meet with in a pure state have been taken out of combination and reduced to simplicity by human agency. The various metals that we ordinarily use are mostly found in a state of ore, and we do not generally obtain them pure except by smelting. The air we breathe, though not a compound, is a mixture. The water which is essential to our life is a compound. And, if we pass from inorganic to organic substances, all vegetables and animals are compound, sustained by various articles of food which go to make up their frames. Now, how have these compounds been formed? It is quite possible that some of them, or all of them to some extent, may have been formed from the first. If Science could go back to the beginning of all things, which it obviously can not, it might find the composition already accomplished, and be compelled to start with it as a given fact—a fact as incapable of scientific explanation as the existence of matter at all. But, on the other hand, composition and decomposition is a matter of every-day experience. Our very food could not nourish us except by passing through these processes in our bodies; and by the same processes we prepare much of our food before consuming it. May not Science go back to the time when these processes had not yet begun? May not the starting-point of the history of the universe be a condition in which the simple elements were still uncombined? If Science could go back to the beginning of all things, might we not find all the elements of material things ready indeed for the action of the inherent forces which would presently unite them in an infinite variety of combinations, but as yet still separate from each other? Scattered through enormous regions of space, but drawn together by the force of gravitation; their original heat, whatever it may have been, increased by their mutual collision; made to act chemically on one another by such increase or by subsequent decrease of temperature; perpetually approaching nearer to the forms into which, by the incessant action of the same forces, the present universe has grown—these elements, and the working of the several laws of their own proper nature, may be enough to account scientifically for all the phenomena that we observe. We do not even then get back to regularity. Why these elements, and no others; why in these precise quantities; why so distributed in space; why endowed with these properties: still are questions which Science can not answer, and there seems no reason to expect that any scientific answer will ever be possible. Nay, I know not whether it may not be asserted that the impossibility of answering one at least among these questions is capable of demonstration. For

the whole system of things, as far as we know it, depends on the perpetual rotation of the heavenly bodies; and without original irregularity in the distribution of matter no motion of rotation could ever have spontaneously arisen. And, if this irregularity be thus original, Science can give no account of it. Science, therefore, will have to begin with assuming certain facts for which it can never hope to account. But it *may* begin by assuming that, speaking roughly, the universe was always very much what we see it now, and that composition and decomposition have always nearly balanced each other, and that there have been from the beginning the same sun and moon and planets and stars in the sky, the same animals on the earth and in the seas, the same vegetation, the same minerals; and that though there have been incessant changes, and possibly all these changes in one general direction, yet these changes have never amounted to what would furnish a scientific explanation of the forms which matter has assumed. Or, on the other hand, Science *may* assert the possibility of going back to a far earlier condition of our material system; may assert that all the forms of matter have grown up under the action of laws and forces still at work; may take as the initial state of our universe one or many enormous clouds of gaseous matter, and endeavor to trace with more or less exactness how these gradually formed themselves into what we see. Science has lately leaned to the latter alternative. To a believer the alternative may be stated thus: We all distinguish between the original creation of the material world and the history of it ever since. And we have, nay all men have, been accustomed to assign to the original creation a great deal that Science is now disposed to assign to the history. But the distinction between the original creation and the subsequent history would still remain, and forever remain, although the portion assigned to the one may be less, and that assigned to the other larger, than was formerly supposed. However far back Science may be able to push its beginning, there still must lie behind that beginning the original act of creation—creation not of matter only, but of the various kinds of matter, and of the laws governing all and each of those kinds, and of the distribution of this matter in space.

This application of the abstract doctrine of evolution gives it an enormous and startling expansion—so enormous and so startling that the doctrine itself seems absolutely new. To say that the present grows by regular law out of the past is one thing; to say that it has grown out of a distant past in which as yet the present forms of life upon the earth, the present vegetation, the seas and islands and continents, the very planet itself, the sun and moon, were not yet made—and all this also by regular law—that is quite another thing. And the bearings of this new application of science deserve study.

Now, it seems quite plain that this doctrine of evolution is in no sense whatever antagonistic to the teachings of religion, though it may

be, and that we shall have to consider afterward, to the teachings of revelation. Why, then, should religious men, independently of its relation to revelation, shrink from it, as very many unquestionably do? The reason is that, while this doctrine leaves the truth of the existence and supremacy of God exactly where it was, it cuts away, or appears to cut away, some of the main arguments for that truth.

Now, in regard to the arguments whereby we have been accustomed to prove or to corroborate the existence of a Supreme Being, it is plain that, to take these arguments away, or to make it impossible to use them, is not to disprove or take away the truth itself. We find every day instances of men resting their faith in a truth on some grounds which we know to be untenable, and we see what a terrible trial it sometimes is when they find out that this is so, and know not as yet on what other ground they are to take their stand. And some men succumb in the trial, and lose their faith, together with the argument which has hitherto supported it. But the truth still stands, in spite of the failure of some to keep their belief in it, and in spite of the impossibility of supporting it by the old arguments.

And, when men have become accustomed to rest their belief on new grounds, the loss of the old arguments is never found to be a very serious matter. Belief in revelation has been shaken again and again by this very increase of knowledge. It was unquestionably a dreadful blow to many in the days of Galileo to find that the language of the Bible in regard to the movement of the earth and sun was not scientifically correct. It was a dreadful blow to many in the days of the Reformation to find that they had been misled by what they believed to be an infallible Church.

Such shocks to faith try the mettle of men's moral and spiritual convictions, and they often refuse altogether to hold what they can no longer establish by the arguments which have hitherto been to them the decisive, perhaps the sole decisive, proofs.

And yet, in spite of these shocks, belief in revelation is strong still in men's souls, and is clearly not yet going to quit the world.

But let us go on to consider how far it is true that the arguments which have hitherto been regarded as proving the existence of a Supreme Creator are really affected very gravely by this doctrine of evolution.

The main argument, which at first appears to be thus set aside, is that which is founded on the marks of design, and which is worked out in his own way with marvelous skill by Paley in his "Natural Theology." Paley's argument rests, as is well known, on the evidence of design in created things, and these evidences he chiefly finds in the framework of organized living creatures. He traces with much most interesting detail the many marvelous contrivances by which animals of various kinds are adapted to the circumstances in which they are to live, the mechanism which enables them to obtain their food, to

preserve their species, to escape their enemies, to remove discomforts. All nature, thus examined, and particularly all animated nature, seems full of means toward ends, and those ends invariably such as a beneficent Creator might well be supposed to have in view. And while there is undeniably one great objection to his whole argument, namely, that the Creator is represented as an artificer rather than a Creator, as overcoming difficulties which stood in his way rather than as an Almighty Being fashioning things according to his will, yet the argument thus drawn from evidence of design remains exceedingly powerful, and it has always been considered a strong corroboration of the voice within which bids us believe in a God. Now, it certainly seems at first as if this argument were altogether destroyed. If animals were not made as we see them, but evolved by natural law, still more if it appear that their wonderful adaptation to their surroundings is due to the influence of those surroundings, it might seem as if we could no longer speak of design as exhibited in their various organs; the organs, we might say, grow of themselves, some suitable and some unsuitable to the life of the creatures to which they belonged, and the unsuitable have perished and the suitable have survived.

But Paley has supplied the clew to the answer. In his well-known illustration of the watch picked up on the heath by the passing traveler, he points out that the evidence of design is certainly not lessened if it be found that the watch was so constructed that, in course of time, it produced another watch like itself. He was thinking not of evolution, but of the ordinary production of each generation of animals from the preceding. But his answer can be pushed a step further, and we may with equal justice remark that we should certainly not believe it a proof that the watch had come into existence without design if we found that it produced in course of time not merely another watch but a better. It would become more marvelous than ever if we found provision thus made, not merely for the continuance of the species, but for the perpetual improvement of the species. It is essential to animal life that the animal should be adapted to its circumstances; if, besides provision for such adaptation in each generation, we find provision for still better adaptation in future generations, how can it be said that the evidences of design are diminished? Or take any separate organ, such as the eye. It is impossible not to believe, until it be disproved, that the eye was intended to see with. We can not say that light was made for the eye, because light subserves many other purposes besides that of enabling eyes to see. But that the eye was intended for light there is so strong a presumption that it can not easily be rebutted. If, indeed, it could be shown that eyes fulfilled several other functions, or that species of animals which always lived in the dark still had fully-formed eyes, then we might say that the connection between the eye of an animal and the light of heaven was accidental. But the contrary is notoriously the case—so much the case

that some philosophers have maintained that the eye was formed by the need for seeing, a statement which I need take no trouble to refute, just as those who make it take no trouble to establish, I will not say truth, but even its possibility. But the fact, if it be a fact, that the eye was not originally as well adapted to see with as it it is now, and that the power of perceiving light and of things in the light grew by degrees, does not show, nor even tend to show, that the eye was not intended for seeing with.

The fact is that the doctrine of evolution does not affect the substance of Paley's argument at all. The marks of design which he has pointed out remain marks of design still even if we accept the doctrine of evolution to the full. What is touched by this doctrine is not the evidence of design but the mode in which the design was executed. Paley, no doubt, wrote on the supposition (and at that time it was hardly possible to admit any other supposition) that we must take animals to have come into existence very nearly such as we now know them: and his language, on the whole, was adapted to that supposition. But the language would rather need supplementing than changing to make it applicable to the supposition that animals were formed by evolution. In the one case the execution follows the design by the effect of a direct act of creation; in the other case the design is worked out by a slow process. In the one case the Creator made the animals at once such as they now are; in the other case he impressed on certain particles of matter, which, either at the beginning or at some point in the history of his creation, he endowed with life, such inherent powers that in the ordinary course of time living creatures such as the present were developed. The creative power remains the same in either case; the design with which that creative power was exercised remains the same. He did not make the things, we may say; no, but he made them make themselves. And surely this rather adds than withdraws force from the great argument. It seems in itself something more majestic, something more befitting him to whom a thousand years are as one day and one day as a thousand years, thus to impress his will once for all on his creation, and provide for all its countless variety by this one original impress, than by special acts of creation to be perpetually modifying what he had previously made. It has often been objected to Paley's argument, as I remarked before, that it represents the Almighty rather as an artificer than a creator, a workman dealing with somewhat intractable materials and showing marvelous skill in overcoming difficulties rather than a beneficent Being making all things in accordance with the purposes of his love. But this objection disappears when we put the argument into the shape which the doctrine of evolution demands, and look on the Almighty as creating the original elements of matter, determining their number and their properties, creating the law of gravitation whereby as seems probable the worlds have been formed, creating the various laws of chemical and physical

action, by which inorganic substances have been combined, creating above all the law of life, the mysterious law which plainly contains such wonderful possibilities within itself, and thus providing for the ultimate development of all the many wonders of nature.

What conception of foresight and purpose can rise above that which imagines all history gathered as it were into one original creative act from which the infinite variety of the universe has come and more is coming even yet?

And yet again, it is a common objection to Paley's and similar arguments that, in spite of all the tokens of intelligence and beneficence in the creation, there is so much of the contrary character. How much there is of apparently needless pain and waste! And John Stuart Mill has urged that either we must suppose the Creator wanting in omnipotence or wanting in kindness to have left his creation so imperfect. The answer usually given is that our knowledge is partial, and, could we see the whole, the objection would probably disappear. But what force and clearness are given to this answer by the doctrine of evolution, which tells us that we are looking at a work which is not yet finished, and that the imperfections are a necessary part of a large design the general outlines of which we may already trace, but the ultimate issue of which, with all its details, is still beyond our perception! The imperfections are like the imperfections of a half-completed picture not yet ready to be seen; they are like the bud which will presently be a beautiful flower, or the larva of a beautiful and gorgeous insect; they are like the imperfections in the moral character of a saint who nevertheless is changing from glory to glory.

To the many partial designs which Paley's "Natural Theology" points out, and which still remain what they were, the doctrine of evolution adds the design of a perpetual progress. Things are so arranged that animals are perpetually better adapted to the life they have to live. The very phrase which we commonly use to sum up Darwin's teaching, the survival of the fittest, implies a perpetual diminution of pain and increase of enjoyment for all creatures that can feel. If they are fitter for their surroundings, most certainly they will find life easier to live. And, as if to mark still more plainly the beneficence of the whole work, the less developed creatures, as we have every reason to believe, are less sensible of pain and pleasure; so that enjoyment appears to grow with the capacity for enjoyment, and suffering diminishes as sensitivity to suffering increases. And there can be no doubt that this is in many ways the tendency of nature. Beasts of prey are diminishing; life is easier for man and easier for all animals that are under his care: many species of animals perish as man fills and subjugates the globe, but those that remain have far greater happiness in their lives. In fact, all the purposes which Paley traces in the formation of living creatures are not only fulfilled by what the Creator has done, but are better fulfilled

from age to age. And, though the progress may be exceedingly slow, the nature of the progress can not be mistaken.

If the "Natural Theology" were now to be written, the stress of the argument would be put on a different place. Instead of insisting wholly or mainly on the wonderful adaptation of means to ends in the structure of living animals and plants, we should look rather to the original properties impressed on matter from the beginning, and on the beneficent consequences that have flowed from those properties. We should dwell on the peculiar properties that must be inherent in the molecules of the original elements to cause such results to follow from their action and reaction on one another. We should dwell on the part played in the universe by the properties of oxygen, the great purifier, and one of the great heat-givers; of carbon, the chief light-giver and heat-giver; of water, the great solvent and the store-house of heat; of the atmosphere and the vapors in it, the protector of the earth which it surrounds. We should trace the beneficent effects of pain and pleasure in their subservience to the purification of life. The marks of a purpose impressed from the first on all creation would be even more visible than ever before.

And we could not overlook the beauty of nature and of all created things as part of that purpose, coming in many cases out of that very survival of the fittest of which Darwin has spoken, and yet a distinct object in itself. For this beauty there is no need in the economy of Nature whatever. The beauty of the starry heavens, which so impressed the mind of Kant that he put it by the side of the moral law as proving the existence of a Creator, is not wanted either for the evolution of the world or for the preservation of living creatures. Our enjoyment of it is a superadded gift certainly not necessary for the existence or the continuance of our species. The beauty of flowers, according to the teaching of the doctrine of evolution, has generally grown out of the need which makes it good for plants to attract insects. The insects carry the pollen from flower to flower, and thus, as it were, mix the breed; and this produces the stronger plants which outlive the competition of the rest. The plants, therefore, which are most conspicuous gain an advantage by attracting insects most. That successive generations of flowers should thus show brighter and brighter colors is intelligible. But the beauty of flowers is far more than mere conspicuousness of colors, even though that be the main ingredient. Why should the wonderful grace, and delicacy, and harmony of tint be added? Is all this mere chance? Is all this superfluity pervading the whole world and perpetually supplying to the highest of living creatures, and that, too, in a real proportion to his superiority, the most refined and elevating of pleasures, an accident without any purpose at all? If evolution has produced the world such as we see and all its endless beauty, it has bestowed on our own dwelling-place in lavish abundance and in marvelous perfection that on which men

spend their substance without stint, that which they value above all but downright necessities, that which they admire beyond all except the law of duty itself. We can not think that this is not designed, nor that the Artist who produced it was blind to what was coming out of his work.

Once more, the doctrine of evolution restores to the science of nature the unity which we should expect in the creation of God. Paley's argument proved design, but included the possibility of many designers. Not one design, but many separate designs, all no doubt of the same character, but all worked out independently of one another, is the picture that he puts before us. But the doctrine of evolution binds all existing things on earth into one. Every mineral, every plant, every animal has such properties that it benefits other things besides itself, and derives benefit in turn. The insect develops the plant, and the plant the insect; the brute aids in the evolution of the man, and the man in that of the brute. All things are embraced in one great design, beginning with the very creation. He who uses the doctrine of evolution to prove that no intelligence planned the world, is undertaking the self-contradictory task of showing that a great machine has no purpose by tracing in detail the marvelous complexity of its parts, and the still more marvelous precision with which all work together to produce a common result.

To conclude, the doctrine of evolution leaves the argument for an intelligent Creator and Governor of the world stronger than it was before. There is still as much as ever the proof of an intelligent purpose pervading all creation. The difference is, that the execution of that purpose belongs more to the original act of creation, less to acts of government since. There is more divine foresight, there is less divine interposition; and whatever has been taken from the latter has been added to the former.

Some scientific students of nature may fancy they can deduce in the working out of the theory results inconsistent with religious belief; and in a future lecture these will have to be examined; and it is possible that the theory may be so presented as to be inconsistent with the teaching of revelation. But, whatever may be the relation of the doctrine of evolution to revelation, it can not be said that this doctrine is antagonistic to religion in its essence. The progress of science in this direction will assuredly end in helping men to believe with more assurance than ever that the Lord by wisdom hath founded the earth, by understanding hath he established the heavens.

LIQUEFACTION OF THE ELEMENTARY GASES.

By JULES JAMIN, of the Institute of France.

THE earlier experiments of MM. Cailletet and Raoul Pictet in the liquefaction of gases, and the apparatus by means of which they performed the process, were described in "The Popular Science Monthly," March and May, 1878. The experiments have since been continued and improved upon by MM. Cailletet and Pictet, and others, with more complete results than had been attained at the time the first reports were published, and with the elucidation of some novel properties of gases, and the disclosure of relations, previously not well understood, between the gaseous and the liquid condition. The experiments of Faraday, in the compression of gases by the combined agency of pressure and extreme cold, left six gases, which still refused to enter into the liquid state. They were the two elements of the atmosphere (oxygen and nitrogen), nitric oxide, marsh-gas, carbonic oxide, and hydrogen. Many new experiments were tried before the principle that governs the change from the gaseous to the liquid, or from the liquid to the gaseous form, was discovered. Aimé sank manometers filled with air into the sea till the pressure upon them was equal to that of four hundred atmospheres; Berthelot, by the expansion of mercury in a thermometer-tube, succeeded in exerting a pressure of seven hundred and eighty atmospheres upon oxygen. Both series of experiments were without result. M. Cailletet, having fruitlessly subjected air and hydrogen to a pressure of one thousand atmospheres, came to the conclusion that it was impossible to liquefy those gases at the ordinary temperature by pressure alone. Previously it had been thought that the obstacle to condensing gases by pressure alone lay in the difficulty of obtaining sufficient pressure, or in that of finding a vessel suitable for manipulation that would be capable of resisting it. M. Cailletet's thought led to the discovery of another fundamental property of gases.

The experiments of Despretz and Regnault had shown that the scope of Mariotte's law (that the volume of gases increases or diminishes inversely as the pressure upon them) was limited, and that its limits were different with different substances. Andrews confirmed the observations of these investigators, and extended them. Compressing carbonic acid at 13° C. (55° Fahr.), he found that the rate of diminution in volume increased more rapidly than Mariotte's law demanded, and at a progressive rate. At fifty atmospheres the gas all at once assumed the liquid form, became very dense, and fell to the bottom of the vessel, where it remained separated from its vapor by a clearly defined surface, like that which distinguishes water in the air. Experimenting in the same way with the gas at a higher tem-

perature (21° C., or 70° Fahr.), he found that the same result was produced, but more slowly; and it seemed to be heralded in advance by a more rapid diminution in volume previous to the beginning of the change, which continued after the process had been accomplished; as if an anticipatory preparation for the liquid state were going on previous to the completion of the change. Performing the experiment again at 32° C. (90° Fahr.), the anticipatory preparation and the after-continuation of the contraction were more marked, and, instead of a separate and distinct liquid, wavy and mobile striæ were perceived on the sides of the vessel as the only signs of a change of state which had not yet been effected. At temperatures above 32° C. (90° Fahr.), there were neither striæ nor liquefaction, but there seemed to be a suggestion of them, for, under a particular degree of pressure, the density of the gas was augmented, and its volume diminished at an increasing rate. The temperature of 32° C. (90° Fahr.) is, then, a limit, marking a division between the temperatures which permit and those which prevent liquefaction; it is the *critical point*, at which is defined the separation, for carbonic acid, between two very distinct states of matter. Below this point, the particular matter may assume the aspect of a liquid; above it, the gas can not change its appearance, but enters into the opposite constitution from that of a liquid.

Generally, a liquid has considerably greater density than its vapor. But, if a vessel containing both is heated, the liquid experiences a dilatation which is gradually augmented till it equals and even exceeds that of the gas; whence, of course, an equal volume of the liquid will weigh less and less. On the other hand, a constantly larger quantity of vapor is formed, which accumulates above the liquid and becomes heavier and heavier. Now, if the density of the vapor increases, and that of the liquid diminishes, they will reach a point, under a suitable temperature, when they will be the same. There will then be no reason for the liquid to sink or the vapor to rise, or for the existence of any line of separation between them, and they will be mixed and confounded. They will no longer be distinguishable by their heat of constitution. It is true that, in passing into the state of a vapor, a liquid absorbs a great deal of latent heat, but that is employed in scattering the molecules and keeping them at a distance; and there will be none of it if the distance does not increase. We are then, at this stage of our experiments, in the presence of a critical point, at which we do not know whether the matter is liquid or gaseous; for, in either condition, it has the same density, the same heat of constitution, and the same properties. It is a new state, the *gaso-liquid* state. An experiment of Cagniard-Latour re-enforced this explanation of the phenomena. Heating ether in closed vessels to high temperatures, he brought it to a point where the liquid could be made wholly to disappear, or to be suddenly reformed on the slightest elevation or the slightest depression of temperature, accordingly as it was raised just above or cooled

to just below the critical point. The discovery of these properties suggested an explanation of the failure of previous attempts to liquefy air. Air at ordinary low temperatures is in the gaso-liquid condition, and its liquefaction is not possible except when a difference exists between the density of the vapor and that of the liquid greater than it is possible to produce under any conditions than can exist then. It was necessary to reduce the temperature to below the critical point; and it was by adopting this course that MM. Cailletet and Raoul Pictet achieved their success. The rapid escape of the compressed gas itself from a condition of great condensation at an extremely low temperature was employed as the agent for producing a greater degree of cold than it had been possible before to obtain. M. Cailletet used oxygen escaping at — 29° C. from a pressure of three hundred atmospheres; M. Raoul Pictet, the same gas escaping at —140° from a pressure of three hundred and twenty atmospheres; and both obtained oxygen and nitrogen, and M. Pictet hydrogen in what they thought was a liquid, and possibly even in a solid form.

Still, it could not be asserted that hydrogen and the elements of the air had been completely liquefied. These gases had not yet been seen collected in the static condition at the bottom of a tube and separated from their vapors by the clearly defined concave surface, which is called a *meniscus*. The experiments had, however, proved that liquefaction is possible at a temperature of below —120° C. (—184° Fahr.). To make the process practicable, it was only necessary to find sufficiently powerful refrigerants; and these were looked for among gases that had proved more refractory than carbonic acid and protoxide of nitrogen. M. Cailletet selected ethylene, a hydrocarbon of the same composition as illuminating gas, which, when liquefied by the aid of carbonic acid and a pressure of thirty-six atmospheres, boils at —103° C. (—153° Fahr.). M. Wroblewski, of Cracow, who had witnessed some of M. Cailletet's experiments, and obtained his apparatus, and M. Olzewski, in association with him, also experimented with ethylene, and had the pleasure of recording their first complete success early in April, 1883. Causing liquid ethylene to boil in an air-pump vacuum at —103° C., they were able to produce a temperature of —150° C. (—238° Fahr.), the lowest that had ever been observed. Oxygen, having been previously compressed in a glass tube, became a permanent liquid, with a clearly defined meniscus. It presented itself, like the other liquefied gases, under the form of a transparent and colorless substance, resembling water, but a little less dense. Its critical point was marked at —113° C. (—171° Fahr.), below which the liquid could be formed, but never above it; while it boiled rapidly at —186° C. (—303° Fahr.). A few days afterward, the Polish professors obtained the liquefaction of nitrogen, a more refractory gas, under a pressure of thirty-six atmospheres, at —146° C. (—231° Fahr.). Long, difficult, and expensive operations were re-

quired to produce this result, for the extreme degree of cold it demanded had to be produced by boiling large quantities of ethylene in a vacuum. M. Cailletet devised a cheaper process, by employing another hydrocarbon that rises from the mud of marshes, and is called *formene*. It is less easily liquefied than ethylene, but for that very reason can be boiled in the air at a lower temperature, or at —160° C. (—256° Fahr.); and at this temperature nitrogen and oxygen can be liquefied in a bath of formene as readily as sulphurous acid in the common freezing mixture.

MM. Cailletet, Wroblewski, and Olzewski have continued their experiments in liquefaction and acquired increased facility in the handling of liquid ethylene, formene, atmospheric air, oxygen, and nitrogen. M. Olzewski was able to report to the French Academy of Sciences, on the 21st of July, 1884, that by placing liquefied nitrogen in a vacuum he had succeeded in producing a temperature of —213° C. (—351° Fahr.), under which hydrogen was liquefied. Contrary to the suppositions founded on the metallic behavior of this element, that it would present the appearance of a molten metal, like mercury, the liquid had the mobile behavior and the transparency of the hydrocarbons.

THE OIL-SUPPLY OF THE WORLD.*

II.

MANY and varied are the uses to which human ingenuity has already contrived to turn this precious gift of dirty-green earth-oil. At first its value was only recognized as a lubricating oil for machinery, and a somewhat dangerous burning-oil for illuminating, commonly called kerosene. Now it has been discovered that, by careful refining, all the highly inflammable naphtha, which is the dangerous ingredient, can be separated, and made valuable to painters and chemists, while the oil, thus purified, becomes absolutely safe for domestic use. Another valuable product of petroleum is gasolene—a form of gas most convenient for use in country houses. Then comes precious paraffine, in the form of beautiful wax-light candles, and vaseline, for healing broken skin or bruises. For medical use we have an anæsthetic called rhigolene, and for cleansing we have benzine. Various volatile ethers have been obtained, among others a petroleum-spirit, which acts as a substitute for turpentine, and which will dissolve lacquer. And, after all these good things have been separated, there still remains a residuum of tar, which yields anthracene, benzole, and naphthaline, from which are obtained a madder-red, mauve, magenta, and indigo-blue dyes, which bid fair to supersede those already known to commerce,

* Abridged from "Blackwood's Magazine."

and even seriously to affect the interests of our indigo-planters, as they have already injured the madder-cultivators of Turkey and Holland.

America has devised various furnaces, of which petroleum is the only fuel. These are chiefly used by metal-workers, as it is found that in such labor as bending armor-plates, and iron-work generally, mineral oil raises the required heat in half the time required by iron.

From America we turn to Asia, which, in more senses than one, may be called the Cradle of Light; for there is good reason to believe that, upward of four thousand years ago, the people of Nineveh and Babylon had found out this use for the mineral oil which flowed from the fountains of Is, on the Euphrates. It was collected in great pits, and the more solid deposits formed the asphalt (or, in Biblical phrase, "slime") which was used by the builders of Babylon to cement their sun-dried bricks.

Whether the petroleum-springs and asphalt-shores of the Dead Sea—the Lake Asphaltites—were ever turned to equally practical purpose does not appear; but Burmah has long recognized the value of her home supplies of earth-oil, derived from wells near the river Irrawaddy; and Burmese naphtha and Rangoon tar find their way even to British markets. These Burmese wells are sunk to a depth of about sixty feet, and yield an oil of the consistency of treacle.

I am told that Hindostan and Siberia have alike received their share in this distribution of the earth-mother's gifts, and that both in China and Japan native naphtha has long been employed in certain districts for burning in lamps. I infer, however, that the production can not be very great, as the consumption of American kerosene in those countries is already enormous, and it has found its way to small villages in remote districts of Japan, to which no less than 5,600 tons were last year imported from America. China generally welcomes such foreign boons less readily; but even the Celestial Empire does not disdain to accept cheap oil, and 82,000 tons were there disposed of last year, while India consumed 94,000 tons.

The Guebres of Persia have ever recognized a sacred fire-symbol in the flame of the native naphtha which flows from the soil in various parts of Persia in so pure a form as to burn without rectification—in fact, the name, though now applied to various artificially produced fluids, is derived from the Persian word *nafata*, "to exude." In its purest natural form it is a light, colorless fluid, consisting of carbon and hydrogen, without any oxygen. In Persia, fire-temples were erected near the naphtha-springs, and reverent pilgrims came from afar to worship at the temple of Surukhani, on the western shore of the Caspian, where, for at least two thousand years, the sacred earth-fed flame burned unceasingly.

In the American consul's report for 1880, he mentioned that this temple was still frequented, that priests came from India to conduct the services, and that inexhaustible supplies of gas to feed the sacred

flame were obtained by merely inserting pipes into the earth. A later report, however, states that since this spot has become so important a center of busy trade and the springs have been desecrated by the imprisonment of the oil and gas in vulgar commercial tanks and pipes, the ancient fire-temple has been abandoned, and in place of reverent worshipers, wondering travelers go for an evening row on the Caspian, to visit the submarine oil-springs to the south of the town of Baku, whence petroleum and naphtha rise to the surface, forming little eddies on the shallow waters (the depth of the sea at this point being only about fourteen feet). On to each eddy they throw a handful of blazing straw, to ignite the naphtha; and thus, on a still, calm night, the sea itself appears to be in flames at a dozen spots—a truly fairy-like illumination.

Besides these submarine springs, the naphtha which exudes from the ground on every side of the old Persian seaport town of Baku is so exceedingly inflammable that the light naphtha-gas was often known to ignite spontaneously, and play in pale lurid flames above fissures in the rock. On stormy nights, fanned by the wind, these flames blazed up, and this led to the town being considered by the Guebres a place of great sanctity. Arabian chroniclers likewise tell of a great volcanic mountain, now extinct, but which, eight centuries ago, was in full action, and doubtless contributed to inspire the fire-worshipers with reverence for the neighborhood.

Great, however, is the change that has come over the sleepy Persian town, with its limited trade in silk and opium, salt, naphtha, and perfumes, since the genius of commerce here established itself, and commenced working so thoroughly in earnest that Baku, which ten years ago was the peaceful home of some 12,000 persons, has now developed into a great commercial center, and a place of daily increasing political importance. It already numbers 30,000 inhabitants, and has very large shipping interests. And this transformation is wholly and solely due to petroleum.

The town which has acquired a new celebrity with such strange rapidity is situated on the Apsheron Peninsula, which is a high, sandy plain, about fifteen miles in width, and projecting thirty miles into the Caspian, from the point where the Caucasus (the mighty boundary which divides European Russia from Asia, Circassia from Georgia) terminates on its shores. It certainly can not be described as an inviting place of residence, for the dry and desert sand is only varied by patches of clay, through which here and there crops up a blue gray-stone.

On every side the ground is black with waste petroleum; indeed, the whole surface of the soil is as a sodden crust, into which, in hot sunshine, the foot sinks to a depth of two or three inches, while in cold weather it hardens to the consistency of asphalt. Every breath of wind raises blinding clouds of parched sand; and water is so scarce

that the streets are watered with coarse, black naphtha, which lays the dust effectually for about a fortnight, and then forms a thick, brown bituminous dust, that ingrains clothes indelibly, but over which carriages glide noiselessly, so that the inhabitants are at least spared one item of torture. On the other hand, they have to breathe an atmosphere poisoned by the dense smoke pouring from the chimneys of about two hundred and fifty refining-factories, and the whole air is redolent of all-pervading petroleum.

Equally desolate and dreary is the surrounding country, which by nature is totally unproductive. Some morsels are carefully cultivated, but there is no natural vegetation, nothing but great dismal flats saturated with the naphtha, which lies on the surface in pools and lakes.

The principal oil-wells of the Baku district lie at Balaxame or Balakhani, about six miles to the northeast of the town: this is an oil-field about three and a half miles in length by one and a half in breadth. To the south lies a smaller field called Bēbeabat. One fountain at Balakhani, ninety-eight feet in depth, is noted as having been flowing steadily for upward of two years, and still continuing to yield 800 barrels a day. Another well not far off, 490 feet deep, commenced its career by throwing up a jet thirty feet in the air, and then flooding the land with oil for a considerable distance all around, overflowing other wells and several small refineries, so as effectually to stop their work. The roar of the rushing oil and gas could be heard a mile from the spot.

Various flowing wells are said to yield 6,000 barrels a day, and some far more; but, from the fact that these quantities are generally stated in the Russian measure of poods, it is not very easy to realize what is meant. One pood, we learn, is equal to thirty-six pounds English. Hence one thousand poods represent somewhere about sixteen tons. Accounts have just reached England of an oil-fountain which was struck last December, and flows at the rate of from fifty to sixty thousand poods daily, gushing forth with such force as to break in pieces a three-inch cast-iron plate which had been fastened over the well in order to divert the flow in a particular direction. In the same district a huge heap of sand marks the spot where an oil-spring, on being tapped, straightway threw up a column of petroleum to twice the height and size of the Great Geyser in Iceland, forming a huge black fountain two hundred feet in height—a fountain, however, due solely to the removal of the pressure on the confined gas, for there is no trace of volcanic heat. The fountain was visible for many miles round, and on the first day it poured forth abont two million gallons, equal to fifty thousand barrels.

An enterprising photographer who was on the spot secured a photograph which places this matter beyond cavil. The fountain continued to play for five months, gradually decreasing week by week, till it finally ceased to play, leaving its unfortunate owners (an Armenian

company) well-nigh ruined by the claims brought against them by neighbors whose lands were destroyed by the flood of oil.

Until about nine years ago the working of the oil was entirely in the hands of Russians and Armenians, and everything was done in the most slovenly fashion. The oil drawn from the wells was collected in shallow pits, whence it was ladled into barrels or skins, and then transported eight or ten miles on quaint native carts to the refineries at the town. The purified oil was afterward rebarreled, sent by steamer to the mouth of the Volga, transferred to river-boats, and then again transferred to carts, to be thus conveyed to the railway, and so transported to all parts of Russia. But the labor this involved was great, and the expense of carriage was consequently exorbitant. And all this was greatly in favor of America, which could still contrive to pay freight from Pennsylvania, and yet undersell the Baku oil-merchants in their own Russian markets.

The beginning of a new commercial and political era (of which we as yet see only the dawn) dates from the year 1875, when Ludwig Nöbel (one of two Swedish brothers, engineers, whose father had settled in St. Petersburg as a gunsmith) sent his brother Robert to the Caucasus to purchase walnut-wood suitable for making gun-stocks. On his journey Robert Nöbel chanced to visit Baku, and was so struck with the wonderful capabilities of the oil-region that, on relating his impression to Ludwig, the latter sent him back to make further investigations, and soon afterward followed in person, when he found that the reality far exceeded all that he had heard.

At once perceiving the enormous advantages to be derived from systematic working, with the aid of iron cisterns and pipes, the brothers sought to interest others in the matter, and induce them to co-operate with them. This, however, they found to be quite in vain. Their theories were all denounced as utter folly. The oil-producers, the land transport corps of carriers, the steamboat and railway companies, all refused to aid their schemes, so there was nothing for it but to start unaided in their own fashion.

They calculated that to do so would involve an outlay of about £1,380,000, and to obtain the needful capital it was necessary to fire others with something of their own enthusiasm. The energetic Swedes were not to be daunted. Difficulties of every sort were thrown in their way, but one by one each was fought and conquered. First they imported a body of wise and steady Swedes whom they could trust to work faithfully for them. They then established great refineries at Baku, laid down oil-pipes thence to the oil-fields of Balakhani (distant upward of six miles), and there commenced scientific boring to a depth greater than had yet been attempted. When their borers struck oil there was no waste, as at the other wells, for the pipes were ready to carry the oil direct to the refineries.

The first step having thus been taken, the next was to avoid the

great cost of barrels (and here we must note that the total absence of timber from all this region is a very serious item in working expenses, as all the wood required for the derricks and other erections must be imported from afar).

In order to dispense with barrels, the Nōbel brothers resolved to carry pipes from their refineries to the sea-coast, so as to pump the oil direct into great iron tanks on board the steamers, whence it might at the end of its voyage be pumped into tanks on the railway, and so carried to great reservoirs in all parts of Russia. As the railway and steamboat companies persisted in their refusal to co-operate, the Nōbels were compelled to take every department of their business entirely into their own hands. So they sent to Stockholm and to Russia to have steamers built specially for their own trade, fitted with great cisterns capable of containing seven hundred and fifty tons of oil, and constructed to burn only oil-fuel. They now own upward of a dozen large steamers on the Caspian, and thirty specially adapted for traffic on the Volga; and, besides these, they charter fully twoscore more steamers to carry their naphtha refuse to various ports for sale.

The petroleum shipped at Baku is carried direct to Tzaritzin on the Volga, whence it is dispatched by rail to every part of the empire in trains, each numbering twenty-five oil-cars. Thus it is conveyed even to the shores of the Baltic, whence it passes on to Sweden, to Germany, and wherever else it can effect an entrance, in determined rivalry to the petroleum of America, which it has already well-nigh expelled from the vast Russian market.

In every direction is the Caspian oil now spreading. In 1883 about a thousand tons were sent to England to try the British market. A somewhat larger quantity was sold in France, and extensive orders were taken for Austria. But it must have required the inventive genius of a Swede to think of sending coals to Newcastle, in the form of sending lubricating oil for machinery to America, and even this has been successfully done! And now that the railway has been completed from Baku to Tiflis, and to Poti and Batoum on the Black Sea, the market of the whole world is open to receive the inexhaustible supplies of the Caucasian oil-fields. Turkey, and all lands on the shores of the Mediterranean, with all that may be reached *via* the Suez Canal and Red Sea, Southern India, China, and Japan—all are open markets for whoever can supply the best oil at the cheapest rate. It is therefore evident that America has now a formidable rival in the field.

Of the relative merits of Pennsylvanian and Caspian oil, it may be said generally that the former yields on an average seventy per cent of kerosene, with a large residuum of lubricating oil. The latter yields only from twenty-five to thirty-five per cent of pure oil, and from twenty to thirty per cent is refuse, only fit for fuel. But here Nature seems to adapt her gifts to the need of the recipients, since

the American oils flow in the heart of the forests, while in Central Asia the oil-fuel makes existence and travel possible.

As regards quantity, in the year 1872 only 212,000 barrels were saved from the waste at the Caspian wells. In 1881 the amount rescued was 4,000,000 barrels, equal to 160,000,000 gallons. In the same year America produced 1,450,000,000 gallons. Commenting on these figures, Ludwig Nöbel says that the same amount could annually be produced at Baku without the slightest difficulty, but that at present it would be useless to do so, owing to difficulties of cheap transport. As it is, great stores lie waste for lack of purchasers, and the amount wasted is fully equal to that which is exported.

As regards price, which in America has varied from tenpence to one penny per gallon, it has at Baku fluctuated from one shilling and eightpence to one penny. In like manner, the barrel of forty gallons of crude petroleum, which in the days of monopoly sold at Baku for eight shillings, has latterly fetched fourpence, and by the latest accounts was further reduced to threepence halfpenny per ton on the spot! This is due to the enormous increase in the supply. Thus, last November a steady-going old well, which for the past ten years has been quietly yielding a fair amount of oil, suddenly commenced to play, and thenceforth threw up a daily average of five hundred tons!

The supply is apparently altogether inexhaustible, for already twelve thousand square miles in this region have been proved to be oleiferous, and of this vast surface only six miles are as yet being developed. The oil-bearing stratum is found to extend beneath the Caspian Sea, where it crops up in Tcheliken, a true isle of oil, which literally streams into the sea from hills and cliffs which are entirely formed of ozokerite—in other words, of crude paraffine.

On the eastern shore of the Caspian it reappears at Krasnovodsk and elsewhere. A hundred miles inland lies the Neft, or Naphtha Hill, whose deposits are officially valued at £35,000,000 sterling—oleonapht, as this particular material is called, being found especially valuable for lubricating machinery; so it promises to become an important article of export.

The oil-bearing stratum also reappears in the opposite direction; for as Baku lies at the eastern extremity of the Caucasus range, so at its western extremity, on the shores of the Black Sea, lies another great petroleum-region in the river-basin of the Kouban River, in the province of the same name. This oil-field, extending over about two hundred and fifty miles, terminates in the peninsula of Taman, between the Black Sea and the Sea of Azof—a strange region, abounding in mud-volcanoes, some extinct, others still active, which, combined with strong outflows of gas and occasional earthquakes, prove subterranean action to be only quiescent.

The natural petroleum-pits are scattered in all directions; some lie

in deep valleys, others nearly nine hundred feet above the sea-level. In some places the gas bubbles up through pools and lakes, which are covered with a rainbow-tinted scum; in others, the thick oil oozes from rock-crevices or bubbles up in mud-volcanoes. In some valleys there are regular terraces of a thick paste resembling asphalt, and smelling of petroleum. Rich deposits of ozokerite and flowing wells of petroleum have been partly worked, and it is noted that the oil here is of a yellowish-green color, while that at Baku varies from very dark green to transparent lilac. These Kouban deposits are as yet quite undeveloped, but it is evident that, from their local position on the shores of the Black Sea, they must soon attain to considerable importance. In all this region the character of the soil differs essentially from that of the oil-region of the States; here layers of solid limestone are comparatively rare, and the general formation consists of thick layers of clay, sand, quicksand, and sea-shells, telling of a period when the whole formed the ocean-bed. The methods of drilling and pumping have, of course, been adapted to suit these different conditions.

While Ludwig Nöbel continues to be the acknowledged oil-king of the Caspian, his marvelous success has given a tremendous impetus to the whole life of the oil-trade, and numerous capitalists have pressed forward to follow in his footsteps; so that Baku has rapidly developed into a large city, having a coast-line of about six miles sweeping round a well-protected harbor, crowded with shipping. At the close of 1882 the Russian papers noted this increase of shipping as altogether marvelous, seven thousand vessels having cleared the port within the previous six months, and of those fifteen hundred were actually Caspian vessels, chiefly hailing from Baku itself. Of course, many of these were merely small sailing-vessels; but no less than seven hundred steamers are now employed on the regular passenger and freight service of the Caspian and Volga, and some of these are splendid vessels, one at least being lighted throughout with Edison's electric lamps.

These are quite apart from the large and rapidly increasing oil-fleet. In addition to those belonging to Messrs. Nöbel, a Russian company (the Caucasus and Mercury Company) owns nineteen steamers, and other firms possess many, and are rapidly importing more and more from Finland and elsewhere. Forty new steel steamers, specially fitted with great tanks, were to be delivered to various firms before the close of 1883, and several hundred sailing-vessels have been constructed for the same purpose.

For the accommodation of all these, twenty-five piers have been run into the harbor, many of them fitted with pumps and pipes, in order to fill the great cistern-steamers with the least possible delay. Sixty miles of pipes connect these piers and refineries with the wells.

The most notable feature of all these steamers is, that they are worked entirely with oil-fuel. Newcastle coal will soon cease to find a market on the Black Sea or the Mediterranean—it may even be driven out of the Red Sea, as the use of petroleum refuse in engines becomes better understood. Already it is the only fuel in use on the Caspian, either in the mercantile marine, in the Russian gun-boat flotilla, or on the railways. Even in domestic stoves it is in favor throughout the Caucasus—all government offices in the neighborhood are thus heated—and the people are greatly encouraged in its use, with a view to saving the fast-decreasing forests of the Caucasus.

At present much oil refuse is poured into the sea as the only way to dispose of it, and yet its value as fuel is fully established; for whereas ordinary coal-burning steamers require to devote nearly half their carrying capacity to stowing fuel, those burning oil-refuse find that petroleum gives out twice as much heat as an equal weight of coal, so that they only require to carry half the quantity. The petroleum also requires far less constant attention from stokers than ordinary fuel. No stoking is required, no banking of fires—the whole thing is simple as a gas-stove, and one man can easily manage the simple apparatus composed of two tubes, through one of which trickles the petroleum, while through the other passes a jet of steam, which converts the oil into a spray so inflammable that it ignites, forming a great sheet of flame, which can be regulated at will—and thus steam is always ready at the exact pressure required, and labor and expense are reduced to the minimum. The advocates of coal declare that this fuel produces much heavy smoke and a tarry deposit, and also that it is liable to explosion. All this, however, depends on the refining, which will become more and more perfect as the value of each separate ingredient is more fully realized.

For instance, it is found that the dark waste fluid left after distillation contains four times as much gas as common coal. This has therefore been turned to account, and Messrs. Nöbel, having obtained a government monopoly in the lighting of the town for forty-nine years, have already established two thousand gas-lamps. They have also devised a new process for making candles of kerosene and solid oil for exportation. Soon they purpose turning their attention to the beautiful dyes to be obtained from the refuse tars, which they hope to turn to such good account that Baku shall be known throughout the world for the excellence and cheapness of its colors. Nöbel prophesies that it will become the world's emporium for cheap and beautiful paint in addition to all its other products.

ODDITIES OF ANIMAL CHARACTER.

MR. J. S. MILL, in his essay on "Liberty," long ago warned us against the stupefying influence of custom upon human beings, and held that we ought to encourage eccentricities in each other, and to guard jealously the right to be eccentric, instead of insisting on reducing every one by the hard-and-fast Procrustean standard to a single dead-level of mediocrity. But, whatever our sins may be in this respect toward human beings, surely they are greater still toward the domestic animals. We reduce our horses, so far as possible, to the mechanical condition of locomotive-engines—indeed, eccentric horses might involve very serious dangers to life and limb—our dogs to sentinels, which we drill to a social decorum as rigid as our own; while we regard the eccentricities of a cat with undisguised horror, as the mere prelude to dangerous insanity. No one who watches can fail to see how bigoted we are against anything like a "new departure" among our poor relations. If a man begins to save against his old age, we call it thrift, and praise him as a small capitalist who is giving hostages to fortune; but if a dog accumulates a store of bones or food, we look upon him as indulging in dangerous caprices, which may end in the necessity of putting a bullet through his head. There may be exceptions here and there. Sometimes you will find an old lady who will protect eccentricity in a parrot, a magpie, or a jackdaw, as a bird that has a right to a certain freedom of movement in return for its entertaining attempts at conversation. But, on the whole, there is no sterner standard of conventionality than that which we enforce on our domestic animals. Pet dogs become perfect bigots in favor of the usual, and persecute any attempt to deviate from it on the part even of a more powerful and less favored colleague, as the Inquisition persecuted heresy, or as the court of Russia persecutes Nihilism. There is nothing equal to the indignation of an in-doors dog at any invasion of the privacy of the drawing-room by an out-doors dog, and nothing more melancholy than the servile apologies which the big dog will make to the little one, for even proposing to break through the animal etiquette of the house. The horror of the queen's chamberlain, when once an officer presented himself at the *levée* in the proper court suit diversified by slippers, which he had forgotten to exchange for the regulation boots, was not so great as the horror of the terrier and the Pomeranian when a collie or a setter presents himself on the threshold of their mistress's sitting-room. We smother the genius of our dogs with our conventionalisms, and stifle the originality of our cats with luxurious bribes. We did, indeed, meet the other day, within the precincts of a great cathedral, with a young cat who was spoken of as "epoch-making"—as likely even to originate a new hegira by the

fervor of his genius. But even of his great promise we could gather no articulate account. He was still in the period of early youth, and perhaps was brooding over the designs by which he hoped to transform, in some future day, the world of the cathedral close. But, as a rule, it is certain that we teach our domestic animals as the Cingalese teach their tame elephants, to discourage steadily and effectually everything like eccentricities, whether deliberate or capricious, or assertions of liberty, on the part of their wilder colleagues, and so drill them into our dead-level of habit.

What important variations of character, however, might we not promote if we took more pains to foster what a writer of thirty years ago used to call "the individuality of the individual" among our friends of the lower races! Sir John Lubbock thinks that he has partially taught a poodle to read, but, as a correspondent of ours once suggested, that may be a step in the wrong direction—not a development of the true genius of the dog, but an attempt to merge the genius of the dog in habits peculiar to man, and likely rather to result in ingrafting an imitative humanity on a totally different kind of capacity. On the other hand, in his experiments on ants, Sir John Lubbock has gone on the sounder principle of setting the ants problems to solve for themselves—a principle which has resulted in showing that different races of ants have very different resources, and that different individuals, even in the same race, show a very different amount of resource in dealing with the same difficulty. This is confirmed by what we know of our more intimate friends among the domestic animals; and surely we should do more to develop their capacity by stimulating them to meet difficulties by their own resources than we can effect by taking their training so completely under our own care. Is it not possible that, as things go, the companionship of man is rather an incubus on the natural genius of the inferior animals than a help to its development? It is clear that the ants, at least, are more sagacious in proportion as they live more apart from man, and are thrown upon their own resources. The harvesting-ants of Texas and the leaf-cutting and military ants of Nicaragua are far higher in civilization than the ants of the more densely peopled countries of Europe. In proportion as they have a freer scope for their efforts, their social communities appear to be founded on a more advanced intelligence and organization. Is it not possible that we stunt the intelligence of our humbler fellow-creatures by doing so much for them, and permitting them to do so little for themselves?

Certainly there is far too little disposition to allow of eccentricity in the lower animals and for what comes of eccentricity. Half-domesticated birds, however, will occasionally show very remarkable eccentricities, and even appear to be making experiments—though experiments which we should, of course, regard as of a very unscientific kind—in the modification of their own instincts. The present writer knows

a pigeon of exceedingly eccentric disposition, not unlike "the single gentleman" in Dickens's "Curiosity Shop" in his habits. He keeps seven pigeon-boxes all to himself, and persecutes relentlessly any pigeons which propose to share their dwellings with him. He is as averse to the society even of the gentler sex as was St. Anthony himself in the Egyptian deserts. Not a pigeon will he admit within the circle of his sway. And yet, in spite of this resolute and inveterate bachelorhood, this eccentric pigeon is always endeavoring to build nests, and looking out for objects of an egg-like form, which he thinks it possible to hatch. He will accumulate twigs and straws now here, now there, at very great pains and labor. He will coo sometimes to inanimate objects, sometimes to captive birds of another breed, sometimes to a kitten or a dog, or even a flower-pot, with the quaintest and politest antics. He will sit patiently on china-saucers on the mantelpiece of one room, while he accumulates the materials for a nest on the top of a closet in another room. He does not even drive away the possible mother of a family with more zeal than he shows in seeking to be a good father to some imaginary chick which he seems to expect to elicit from a ring-stand or a letter-weight. So far as the present writer can judge, he is a pigeon of strong Malthusian views, who hopes to inaugurate a new *régime* which may have the same relation to the ordinary habits of pigeons which the Positivist worship bears to the other religions of the world. He hopes to foster and cultivate the family and parental idea without any corresponding reality, without any aid from outside, indeed, except an apparatus of external ceremony, which feigns the existence of a purely ideal mate, and affects to indulge in the expectation of impossible offspring. Doubtless he thinks that there is nothing so good as the courtly attitude of a pigeon toward his mate, especially if there be no mate to justify it; nothing more touching than the patient preparation for offspring and the education of the young, especially if there be no young to complicate the problem of tenderness and foresight, by requiring a real supply of food and attention. This eccentric pigeon seems to be a solitary thinker of the Comtist kind, who hopes to solve the problem of preserving to the full all the higher instincts of bird-life, without the difficulties involved in supplying those instincts with real objects. If a human thinker can empty religion of its meaning, and yet justify all its forms and sentiments and external rites, and if he is to receive nothing but praise for his achievement, why may we not regard with interest and admiration the effort of an eccentric bird to retain all the ceremonial forms of chivalrous observance and elaborate parental care and patience, without, in fact, complicating the situation by admitting the neighborhood of either wife or child? To our mind, the idiosyncrasies of such a creature as this deserve the most attentive study. Who knows whether we might not find in the world of eccentric instinct all sorts of anticipations of eccentric intellect? Who knows

whether we might not find genius and originality in other races of animals which would throw as much light upon the genius and originality of man as the eccentricities of this pigeon seem to throw on the eccentricities of a most active and confident school of modern thought? If John Stuart Mill were right in thinking it a sacred duty not to discourage the milder lunacies of human beings, might we not with equal advantage extend his exhortation, and make it include the duty of protecting the independent development of the idiosyncrasies of bird and beast, in the hope of finding in them some clew to the various oddities and harmless insanities of human thought and action?—*Spectator.*

BIOGRAPHICAL SKETCH OF E. B. TYLOR.

AMONG the most prominent of the British scientists, attracted to the recent meeting at Montreal, was the President of the Anthropological Section, EDWARD BURNETT TYLOR. He is well known as a distinguished author on the early history of the races of mankind, and his investigations of this comprehensive subject entitle him to an eminent rank among the founders of the recently established science of anthropology.

He was born at Camberwell, about four miles from St. Paul's Cathedral, London, on October 2, 1832. He was of Quaker parentage, and was educated principally at the school of the Society of Friends, Grove House, Tottenham. He was a fair classical scholar, and had mastered the differential calculus, when at sixteen he entered his father's manufactory in London, with the intention of pursuing a business career. But at twenty, soon after the death of his father and mother, symptoms of consumption, or what became dangerous symptoms, appeared. He then traveled in the United States and Mexico for two years to recruit his health. On his return to England he had a severe attack of phthisis, and his case was several times declared hopeless by eminent physicians, but, after spending several winters on the Riviera, he partially recovered. He was then advised that he might marry, and this completed his restoration, his wife taking excellent care of his health. He is now a strong, broad-chested man, six feet high, in the full enjoyment of mental and bodily vigor.

Dr. Tylor was not a university man, and the circumstances which turned his attention to the department of knowledge to which he has devoted himself and the influences by which he was impelled to pursue it are interesting. He entered into scientific life under unusual advantages, having the opportunity of meeting many eminent scientific men

at home, as his elder brother* was an active geologist. His family resided near that of the late R. Philipps, a well-known chemist, and brother of W. Philipps, the mineralogist; and it was mainly through the influence of the Philippses that the Tylor family received its early scientific bias. When residing on the Riviera, at Cannes, he made the acquaintance of Lord Brougham; Mr. Bellinder Ker, a Whig politician, whose father wrote a work on philology; Mr. Hope, who left a large collection of natural history objects to Oxford; and Dr. Falconer, the eminent paleontologist. Young Tylor traveled in Mexico with an old and experienced collector, Mr. H. Christy, to whom everything that was unusual (by whomsoever found) was an object to be carefully preserved. As Christy had been trained by the late Dr. Hodgkin, one of the founders of the Aborigines Protection Society, to interest himself in everything relating to aboriginal man, so Christy trained Tylor to regard nothing as trivial that had any bearing on the mental states of savage men. No preparation could be more invaluable than this for the work of investigation—the collection, analysis, and interpretation of facts—to which Mr. Tylor has since given his undivided attention.

The stimulus of intercourse with cultivated minds is a factor of great moment in determining the career of able young men, and Mr. Tylor seems to have been especially fortunate in those intimate and early associations which depend upon social circumstances. Like Dr. Young the physicist, and Dr. Dalton the chemist, Mr. Tylor came, as we have said, of Quaker parentage; and Sir J. Lister, his schoolfellow, and also his predecessors, Hodgkin and Christy, were Friends, and the Philippses were also born members of the society. Under such favorable associations Mr. Tylor pursued his systematic studies, acquiring a fluent mastery of most of the European languages, and a considerable acquaintance with a dozen more. Without these acquirements he could not have done his work in comparative ethnology, as old translations, made before ethnological science was developed, were not only often useless, but actually misleading.

Dr. Tylor's first work, "Anahuac; or Mexico and the Mexicans," written at Cannes after his return from Mexico, was published in 1861. It gave not only the important results of especial investigations and excavations in Mexico, but it embodied the germ of a new department of the new science of anthropology. As the author was not then much known, and was dealing with a subject still comparatively undeveloped, and perhaps also from its unfortunate title, it did not meet with a success at all proportionate to its undoubted merits. His "Researches into the Early History of Mankind" appeared in 1865, and

* Mr. Alfred Tylor published his first important geological paper in 1852, in "Silliman's Journal." The views it contains, though much opposed at the time, have been quoted by A. R. Wallace in "Island Life," by Professor Huxley in his "Physiography," by Darwin in his book on "Earth-Worms," and by Sir Charles Lyell in his text-books.

was the work which made his reputation. It showed great research, original insight, much constructive power in the formation of systematic views, and a high degree of literary merit. It at once took a position as a standard treatise upon the subject, was translated and republished in different countries, and contributed largely toward the diffusion and acceptance of more rational views on the subject of the earlier and the lower races of mankind than had hitherto prevailed. "Primitive Culture: Researches into the Development of Mythology, Philosophy, Religion, Art, and Custom," appeared in 1871, in two volumes. This was a much more comprehensive work than the former, pursuing the same questions to a more amplified and exhaustive treatment.

The latest considerable work of this author, an educational handbook of the science of man, entitled "Anthropology, an Introduction to the Study of Man and Civilization," was published in 1881. This is undoubtedly the best book upon the subject in our language. It is not a large work, but it condenses an immense amount of information with great skill, so as to bring the exposition into shape for general readers who have no time to peruse and digest ponderous volumes. Dr. Tylor is a very amiable man, and, without saying that he is fastidious and timid, he is undoubtedly solicitous to give the least possible offense in his statements. To show how careful he is to avoid irritating even persons of very confined ideas, it has been remarked that the word "evolution" only occurs once in the "Manual of Anthropology," although the book is broadly based upon that fundamental idea.

Dr. Tylor is an excellent lecturer, and has frequently delivered discourses before learned societies, like the Royal Institution of London, which have been widely published, and are always marked by originality, terseness, and interest. He has contributed to periodicals and encyclopædias, and is a hard worker. He is well known as the author of the theory of animism, and it is claimed that he first introduced or made current the term "survival," now so commonly applied to those vestiges of early habits and ideas which linger on as anomalies long after they went out of their primitive use.

Our author was elected Fellow of the Royal Society in 1871, received the honorary degree of LL. D. from the University of St. Andrews in 1873, and a D. C. L. from the University of Oxford in 1875. He is President of the Anthropological Society, and in March, 1883, he was appointed Keeper of the Oxford University Museum, and in the same year the degree of M. A. was conferred upon him by decree of the House of Convocation. He has also been made reader in anthropology, it being the first provision made by the University of Oxford for teaching that subject.

CORRESPONDENCE.

MORE ABOUT THE BEAVER.

Messrs. Editors:

I HAVE been highly entertained, and gained some new ideas, by reading Dr. Stockwell's article on "The Beaver and his Works" in the "Monthly" for May, 1884. I have myself long since made the acquaintance of the beaver, but in different regions from that studied by Dr. Stockwell. Perhaps that is the reason why my observations in some particulars differ from his. The beaver has, or had, such a wide range, and has been subjected to such different and ever-changing environment, that it is not at all extraordinary if his habits changed and differed more or less in widely separated localities. The doctor remarks that modern science has disproved the statements that the beaver used his tail for a trowel and as a vehicle for transporting loads. How has "modern science" disproved these statements? Has it not been, only, by the failure of some later naturalists to observe the beaver's habits which were reported by older observers? Hence, they assumed that, what they had not seen, no one else ever saw, and on such negative evidence the genius of the beaver has come to be underrated. I will venture to suggest that no modern naturalist has seen quite all the beavers at work, nor examined quite all the beaver-dams, that existed during the last fifty years. Great variation in habits of life in an animal as intellectual and full of resources as the beaver might be expected during that process of persecution to which it has been subjected, and which has reduced its numbers more than a thousand-fold.

In the summer of 1865, while resting late on a cloudy, sultry afternoon near the banks of a stream south of the Niobrara, in Northeastern Nebraska, I had the gratification of seeing a singular beaver-performance. I was sitting on a fallen tree, when I heard a peculiar noise over a rise beyond me. Creeping to the top of the slight elevation, and peeping over, I saw a dozen beavers rolling a small log or thick pole of cottonwood in the direction of a stream. A few were pulling in front, but most of them were pushing from behind. Finally they rolled the log into a shallow depression, whose farther side was much steeper than the side from which they brought it. Their united strength was insufficient to roll it out of this depression, and it was most curious to watch the various manœuvres to accomplish this purpose. First they cut off about eighteen inches of the thick end, and then made another attempt, and again failed. Then they came together almost in a circle as if for consultation. Suddenly they separated, went back to the log, and rolled it about sixteen inches back in the direction from which they brought it. Five of the beavers now went in front, stretched out their tails toward the log, when those behind rolled it on the tails of those in front. The five beavers in front now pulled, those behind pushed, and in a few minutes the log was drawn out of the depression on to comparatively smooth ground. When this was accomplished the imprisoned tails in front were released, and the tails were handled and examined as if they were hurt. Rolling was then resumed. This satisfied me that the stories which I had heard from trappers and Indians about the beaver sometimes using his tail to move burdens was correct.

Again in September, 1870, while attempting to cross a tributary of the Logan River in Wayne County, Nebraska, on the breast of a beaver-dam, owing to a "circus" commenced by my mules, a small portion of the left side of the dam was damaged. Camping near by at dusk, I hid myself among the tall weeds, and waited for developments. The beavers soon appeared, and commenced the process of repair. They carried weeds and mud, and closed up even the tracks left by the mules, and smoothed down the sides of the dam. In doing this, I could distinctly see one, but only one, draw his tail backward and forward over the freshly placed earth and mud.

It is a mistake to suppose that the beaver only resides in or near wooded districts. At the time of which I speak there were still beaver at work on tributaries of the Logan, where there was no timber growing of any kind within twenty miles. In these places they built their dams of tall sunflower-stems, and the stems of other plants that grew luxuriantly on and near the banks. They laid the stems in the water, mainly lengthwise, up and down the stream, bound them together with mud, and made them amazingly strong.

In regard to the manner in which the beavers cut down trees there is some variation. A few years ago in Middle Park, Colorado, I measured the stumps of forty-two trees that were cut down at various times by beavers. In all these cases, except one, the gouging was done to near the center, equally on all sides. In the one exception the cutting was done beyond the center on one side, and only one fifth as far on the other. In Northeastern Nebraska, where, during seven years, I measured stumps of

trees cut down by beavers as opportunity offered, out of two hundred and seventeen measurements of trees, from two to eighteen inches thick, seventy-nine were cut equally on all sides; ninety-two were cut from one fourth to one half inch farther in on one side than the other, and forty-six considerably exceeded this difference. I do not know the cause of this variation, but suspect it comes from attempts to fell trees in certain directions.

Even the houses of the beavers are subject to occasional variation. When going through some of their dwellings in a beaver-dam north of Grand Lake, Colorado, I was struck by one exception to the type-form described by Dr. Stockwell. It had two distinct stories, the lower being partly under water, and partly filled with twigs of quaking-asp. The upper story had the rough walls smoothed inside by having every crevice filled with dead leaves, the whole being almost as smooth as the interior of a bird's nest. I examined many other beaver-houses along the Grand and the tributaries of Grand Lake, but failed to find any that were as elegantly fashioned in the interior as this one.

The facts detailed that came under my observation have confirmed me in the heretical opinion that the older observers, who studied the beaver at close range, drew as little for their facts on their imaginations as the modern naturalists.

SAMUEL AUGHEY.

LINCOLN, NEBRASKA.

CURIOUS CHANGE OF HABIT.

Messrs. Editors:

THE following sketch of a change of habit in a species of snake, the *Liopeltis vernalis*, will doubtless prove interesting to some of the many readers of your valuable "Monthly":

A week or two ago, while walking in the garden, my attention was attracted by the curious actions of the cat, which seemed to be suffering from an epileptic fit, jumping, rolling, and scratching at a great rate. A closer approach revealed that he was busily engaged in trying to throw off a beautiful green snake (the *Liopeltis vernalis*), which in its efforts to escape the claws of its foe, had coiled itself around the cat's body, much to the latter's discomfort. There was no apparent effort at constriction made by the snake, who was evidently waiting for a good chance to escape. Finally, the snake uncoiled itself and tried to seek safety by flight. It was caught, however, while crossing a wide path between the bushes, and handled unmercifully. While struggling under a lilac-bush, about six feet high, a sudden thought, born of necessity, seemed to animate the snake. It twitched itself loose from the grasp of the cat, made for the slender trunk of the lilac-bush, or rather shrub, encircled it, and in a few seconds had made its way to the very top of the shrub, across which it lay extended, watching the futile endeavors of the cat to climb the slender stem of the shrub. After repeated failures, the cat lay down at the foot of the bush, like a tiger waiting for his prey. The resemblance was very striking, the cat being of a tawny gray color with dark bands, a perfect tiger *en miniature*. This blockade continued more than an hour, when the snake took advantage of the momentary inattention of the cat, and quietly glided on to the tops of the adjoining gooseberry-bushes, until he had put about ten feet between his foe and himself. He then glided to the ground, and made his escape, unmolested, much to the grief of my little girl, who wished to have the beautiful little reptile as a pet. The cat continued his blockade for some time longer. He could not be coaxed away until I took him up and held him among the top branches of the shrub, letting him see that the snake was gone.

While every snake has sufficient sense to take hold of anything on which it may be placed, it is very rare for the ordinary ground-snakes to so forsake or modify their terrestrial habit as to voluntarily seek protection above the ground, and thereby cultivating an arboreal habit. This same specimen, under similar circumstances, will, without doubt, pursue a similar course of action, and in time produce a race of terrestrio-arboreal *Liopeltis vernalis*, which, having an advantage over their less highly gifted brethren, according to the principle of the survival of the fittest, should become the final normal type of *Liopeltis vernalis*.

G. A. BRENNAN.

ROSELAND, COOK COUNTY, ILLINOIS.

EXTENT OF THE RECENT EARTHQUAKE.

Messrs. Editors:

BEING interested in science, permit me to say that if you, or any one, proposes to collect facts relative to last Sunday's earthquake, I am quite sure it was felt here. During the afternoon I experienced a strange and unwonted quiver in the floor of my study and a slight movement of the window-sash. It drew my attention at the time as something different from what I had ever observed before. My room is so situated that no movements of persons about the house can shake the floor, and I am certain it was the earthquake. I neglected to note the time, or to suspect the probable cause, being very busy. But another member of my family noticed a strange movement in the house, and crackling sounds in the ceiling of another building were heard.

It is stated also to have been felt at a point twelve miles south of here. This place is eighteen miles south of Rutland, and we call it about two hundred and fifteen miles north of New York by rail, and the railroad route is quite direct—certainly near two hundred.

L. D. MEARS.

DANBY, RUTLAND COUNTY, VERMONT, *August* 13, 1884.

SCIENTIFIC PHILANTHROPY.

Messrs. Editors:

I HAVE just read "Scientific Philanthropy," in the August number of "The Popular Science Monthly." While I agree with the general tenor of the article, yet I wish to make objection to some of the statements.

Sociology is getting to be an exact science; and those who wish to write upon it will have to be much more careful as to what they assert than they have been in the past. All positions are criticised, and nothing will pass but what is true at all times, under all conditions, and in all circumstances.

Mr. Vance says, page 482, "With successive differentiations of individual functions and pursuits, there comes an increasing specialization of each differentiated member of society, and hence industrial virtues and vices, which the parent fixes for the child by heredity, lead to the existence of two very different classes in community — the rich and the poor, the strong and the weak, the rulers and the ruled."

Now, so far as certain industrial virtues or vices fixed by heredity being the source of the two classes, the rich and poor, the rulers and the ruled, I for one entirely deny.

Those classes, as we know them now, are maintained by certain social institutions that give special advantages to those in possession, and prevent others, however possessed of all necessary virtues, from reaching the place for which they were fitted. Of that there are so many proofs that there is only the difficulty of choice.

In England, advancement in the army is only possible to a certain class. In France, where class distinction was abolished, the best officers of the Revolution rose from the ranks.

In the United States, where chances are more equal, it is the common observation that men who come here with money lose it, those who come poor become rich. Does any one suppose that Vanderbilt would be the rich man he is, or Bennett own the "New York Herald," if they had depended upon their inherited virtues for their possession?

But that which can be easily proved is that when a man has reached the upper class, either of riches or rulers, he next strives to pass to his children, not the virtues that brought him there, but the results of his labors; and not only to pass them, but to so arrange matters that the benefits may not be squandered through any follies of theirs.

And when not one man, nor one thousand, but untold generations strive in one special direction, the result is not difficult to perceive.

This result is a class of rich and of rulers that not only hold possession, but who have so intrenched themselves that it is almost impossible to dislodge them, and the battle that is coming on is simply one to equalize the chances, so that the parents will have to transmit the virtues as well as the possession.

There is an undercurrent, deep and strong, that will make itself felt some day before long. Mr. Ward's book, "Dynamic Sociology," is a precursor of it. Those who would check it must be more accurate than the general run of writers on "sociology."

Mr. Vance says, furthermore, page 493; "The sentimentalist employs in sociology the empiric method; in ethics, he builds upon intuition; in political economy, he favors the principle of co-operation."

It may be true of the sentimentalist, but the natural inference that those who favor co-operation are sentimentalists is a great mistake. The principle that works in favor of co-operation is to avoid the immense waste of competition.

ALBERT CHAVANNES,

ADAIR CREEK, TENN., *August* 16, 1884.

EDITOR'S TABLE.

SCIENCE IN SCHOOL MANAGEMENT.

THE progress of popular education is gradually bringing into prominence a class of questions of fundamental importance, the existence of which was hardly recognized in its earlier stages. It seemed at first a very simple affair to organize a common-school system, and nobody anticipated that any very serious difficulties could arise in carrying it out. Children were to be taught the rudiments of knowledge—chiefly reading, writing, and ciphering. There was but little trouble

in finding teachers competent for this work, and no trouble at all in finding any number of men held abundantly qualified to be directors, trustees, managers, and superintendents of such education.

But the system was no sooner entered upon than it began to undergo a series of changes which were, of course, characterized as improvements. There were at first much crudeness, laxity, and irregularity in the schools, and these were to be replaced by better order and closer and more methodical work. The scope of instruction began to widen, and new subjects were introduced. Courses of study were laid out requiring years to complete them. The pupils were classed and graded, and this necessitated the gathering of larger numbers in the same establishment. Lesser schools were absorbed under the policy of expansion. With more diversified study, a complicated system of examinations, markings, and promotions grew up, which required a special apprenticeship of the teachers to work in it. The department of normal schools was instituted to meet the new demands on teachers, and, as the system was regulated by State authority, it was reduced to constantly increasing uniformity in all details of management.

In this way the public schools underwent a radical change, by which what had no existence at first gradually came to be of supreme importance. Liberty on the part of both teacher and pupil disappeared, and they became the passive subjects of inflexible regulation. Rules grew sacred, and there was no sin so great as to be absent from school a day, or not to be promptly on hand at the moment for starting. The officials directed everything, decided what and how much to study, hours of attendance, recesses or no recesses, and put as much or as little pressure as they pleased upon school operations. As a consequence, a gigantic mechanical system was created, the perfection of which consisted in the mechanical element. There are many who think that the system is now essentially perfected, and that, to gain its highest advantages, nothing remains but to augment its resources, and drive it with increasing vigor. Yet experience is disclosing grave difficulties in its working, and difficulties, moreover, which spring out of the alleged perfections of the method. That which characterizes it is the completeness of organization for dealing with pupils in masses; and the vice which is now widely recognized in its operations is, that the individuality of pupils is sacrificed to the perfect working of the mechanical arrangements.

Of course, in the nature of the case, the greater the number of children operated upon, the less is the consideration that can be given to each personality. Children are treated by a plan which implies that they are alike, but the assumption is not true. They are unlike, the differences among them are great; and, when it comes to the processes of education, these differences are fundamental. The fact which is neglected in machine education is the most important fact of the case. The palpable differences in physical aspect by which each is known as an individual extends through the whole nature. Children differ widely in their mental faculties, in their capacity of apprehension and retention, in aptitude for different kinds of mental effort, in quickness of perception, in moral sensibility, and power of self-restraint, in organic soundness, and the capability of endurance. To cultivate them all alike is to do violence to those peculiarities which make up the individuality. They can neither be taught in the same way with the same results, nor plied by the same motives with equal effect, nor subjected to the same degree of strain without injurious consequences. Say what we will, there in an undoubted antagonism between the necessities and rights of individual children and the inexorable

grind of the great educational machine; and experience testifies that the policy of ever-increasing stringency of requirement to which the mechanical system tends only aggravates its evils. In this respect there is nothing self-corrective in our educational methods.

It is not to be denied that a main root of this evil is the incapacity of teachers and of those intrusted with the management of schools to judge intelligently of the results of their system upon the varying natures of children. This is a complex and extensive branch of knowledge to which the normal schools give little attention. Our teachers as now prepared, and our school-officers as now selected, are left in ignorance upon this subject. Instructors are trained in the matters they are to teach. They are drilled in all the petty niceties of preordained school-room studies, and disciplined interminably in all the technical processes of the school system. Superintendents, inspectors, and boards of education are frequently mere business men, often men who have failed in some profession, and sometimes promoted teachers, and that they should know nothing of those physical, mental, and moral characteristics of the children subjected to their charge is inevitable.

And obviously, under the present policy, they can never possess this knowledge. The time is all taken up with other things, the machine is in the ascendant, and the results aimed at must be such as will commend themselves to an ignorant public sentiment. The thorough scientific study of the natures of children, which would qualify a teacher to judge of their differences, and the unequal influence of the system upon them, whether for good or for evil, could only be brought about by a radical reconstruction of the whole method, and the rejection from it of a great deal which is now held of supreme importance. No such profound change is to be expected. There is, therefore, little hope of relief from existing difficulties by any special preparation of teachers for the purpose. And, even if the policy were entered upon, it is extremely doubtful if it could be developed and carried out for many years in any adequate way; and it may be probably laid down as wholly impracticable to qualify the mass of teachers to judge intelligently of the effects of their educational system upon children, even in the single particular of over-pressure, and its influence upon mental and bodily health. Perhaps a few teachers could be specially trained in this direction, so that some degree of intelligence might be brought to bear upon the school-room regimen; but even this is impracticable in the present state of thought upon the subject.

What, then, remains to be done? Is the most important measure of improvement in school management to be given up as forever hopeless? We have said that this defect of our school system is attracting serious attention, and calling forth sharp criticism, but is this to avail nothing for future relief? We are not driven to this alternative, for the sufficient reason that there are men in the community well prepared to deal intelligently and efficiently with the subject. It is the especial business of medical men to understand the human constitution, and all their knowledge relates to what the school system ignores—the peculiarities of the individual. Diagnosis, critical personal observation, is the basis of all medical practice. Moreover, there is an especial branch of medical study that bears directly and immediately upon the questions here involved. There are physicians who give their lives to the investigation of mental science with reference to its corporeal conditions and its problems of health and disease. They are the students of insanity, and all the causes which tend to undermine mental soundness and produce feeble-mindedness in its innumerable forms. These are the men prepared to judge of the working of a school system upon

the natures of children, and it is impossible to see that any reason can be offered for not invoking their services to this important end. Yet, strange to say, our school authorities are the first to resist this reasonable policy. They resent the idea that their system is not already working in perfection, and they virtually maintain that the ignorance of teachers and school officials is just as good for practical guidance as the knowledge and experience of men especially cultivated to deal with cases which are constantly arising, where pupils become the victims of an undiscriminating high-pressure system of school-work.

An illustration of the subject has recently arisen in London, which is attracting public attention in the shape of a controversy between an eminent medical man and a prominent Government official. Dr. Crichton Browne, a distinguished authority on nervous diseases and the treatment of the nsane, pointed out some of the evils attending prevalent school practices, and advocated school inspection by competent physicians. Mr. Mundella, a manufacturer, a philanthropist, and Vice-President of the Government Council, who has large direction of the school, took issue with Dr. Browne, and there came a public contention upon the subject. The London "Lancet" reviewed this controversy, and gave reasons for maintaining that Dr. Crichton Browne had the right of it. The subject is so important that we reprint the "Lancet's" remarks in full:

Leaving the personal issues involved in the regrettable dispute which has been raised by Mr. Mundella's equivocal mode of traversing Dr. Crichton Browne's report on the subject of "over-pressure of work in public elementary schools," we turn to the main question: Is it, or is it not, the fact that over-pressure exists, and that it is doing mischief? The case seems to us to lie in a nutshell, and it would be difficult to cast the underlying hypothesis in a more terse form than that embodied in one of Dr. Crichton Browne's concluding sentences. No one alleges, or for a moment supposes, that the Vice-President of the Council, or any influential member or official of the Educational Department, is either willful or careless in the matter. It is simply a question of policy; and the most that need or can be justly said is said in these words: "It is quite possible that a scholar, whose body is twelve years old, but whose brain stopped growing at eight, might by his pleasing exterior and superficial sharpness impress the inspector with the idea that he is rather clever, while all the time he is childish, not to say babyish, in intellect, and ineducable beyond the first standard." If this be conceded, as we think it must be, then it follows that the inspector is not in a position to determine whether a particular pupil is or is not physically able to do the work required of him or her, and fit safely to be pressed through the educational curriculum. This seems to us to cover every contingency. It is not necessary to argue closely or warmly as to the question of experiences. It is conceivable that not a single case of injury may actually have occurred, and yet the system which makes a non-medical inspector—however humane and competent for his *proper* task—the judge of physico-mental fitness, whether of pupil or pupil teacher, must be indefensible. What are we doing? Simply this: applying a uniform pressure to a vast multitude of brains, some of which must, in the nature of things, be too weak or too ill-developed to bear the strain thrust upon them. It is a monstrous and inexplicable blunder this insistence on a level code of education for *all*. Why, even as regards the muscular and general organism of the soldier and the sailor a medical examination precedes the commencement of drill, and medical inspection from time to time keeps the question of health in view. Muscular weakness is not half so serious a bar to physical training as mind weakness is to intellectual exercise. How comes it to pass, then, that without any medical examination or supervision whatsoever the brains of a multitude of children, the majority of whom are under-bred and ill-fed, should be subjected to the same discipline and required to do the same task? It is not considered enough to know the age of a recruit for the army or navy; means are taken to ascertain whether his heart, lungs, and organs generally are healthy, and medical officers are specially appointed to examine him from time to time with a view to determine whether he is bearing the strain healthily; but no provision whatever is made for testing or watching the immature cerebral organ

upon which the public pedagogue is not only left free, but required, to operate. The mere fact that this obvious measure of individual scrutiny, from the health point of view, is omitted, puts the case for the department out of court.

Dr. Crichton Browne insists that, "in a great number of cases of dullness of intellect, a medical man could at once recognize the physical defects (which are often distinctive enough, although imperceptible except to the medical eye) which accompany mental weakness, and would support the judgment of the teachers; and in many cases of bodily disease and debility he could interefere to protect the children, even against the teachers, by preventing scholars who, although quick-witted and eager to learn, are certain to suffer in the process from being unduly pushed forward." The profession will indorse this statement as one of fact, and with that indorsement the dispute ought to end. Dr. Crichton Browne has undoubtedly proved his case. It is not to the point whether the victims are many or few; the system extant is radically bad; and, that being so, the magnitude of the mischief wrought is of secondary importance. The blunder of striving to enforce a uniform code ought to be repaired without more ado. It may be strictly true, as Lord Shaftesbury has remarked, that "there does not live on the face of the earth a man who is more opposed to tyranny and oppression than Mr. Mundella, or any one more earnestly desirous of putting down all over-pressure as regards women and children." Then why, in the name of common sense, does not the vice-president adopt the suggestion made to him, instead of fighting what must needs be a losing battle against his own moral and statesmanly consciousness of right?

Headaches, short-sightedness, neuralgia, and sleeplessness are not normal contingencies of youth, either for pupil-teachers or children, yet it is a fact which Dr. Crichton Browne has demonstrated, and which men "engaged in the ordinary practice" among the humbler classes, and who, according to Mr. Fitch, are "able to know something of the children of the poor, their pursuits and their ailments," can substantiate, that these troubles—the direct fruits of over-pressure of work—largely prevail. Nothing can be gained by denying this fact, and certainly a lay inspector is not the person to contradict an able and experienced practitioner on the subject. Dr. Crichton Browne modestly says: "I can not doubt that many of the facts which I have brought before you in this letter will be disputed, and that many of the principles which I have incidentally laid down will be challenged; but the former admit of verification, and in the latter I shall, I believe, have the support of the medical profession." We accept the facts and support the principles. If Mr. Mundella is not satisfied with one of the best professional opinions obtainable, let him appoint a small commission of physicians and surgeons, men of mark, in whom he and the public will have confidence, but who are in no sort of way connected with the public service or the department, and let the issue be left in their hands. It is not for Mr. Mundella and his lay inspector to impugn the judgment of a qualified physician. The presumption of so doing does not beseem these gentlemen: it goes better with the crass heartlessness—to use no stronger epithet—of the school manager who, when a wearied mistress ventured to sit while teaching her class, ordered all chairs to be removed from the building! While the administration of our educational system rests in hands like these, there is little hope of success or safety in its operation. For the sake of children and teachers alike, the schools ought at once to be placed under medical supervision. In an able and interesting paper on "The Brain of the School-Child," read before the Social Science Congress at Birmingham, Dr. Francis Warner has insisted on the urgency of the need which exists for medical inspection. We cordially indorse and support his argument. It is the cry of common sense. If the reasonable demand be not met fairly and fully, there can not fail to be disappointment and regret when the inevitable issue of a mistaken and futile policy is fully worked out.

THE ABUSE OF POLITICAL POWER.

WHILE Rome was burning, it is said, Nero fiddled. The merry crackle of the flames, the glaring and tossing of the fiery sea, stirred the irresponsible tyrant to mirth as he heard and surveyed it all from his lofty tower. The story may or may not be mythical, but in either case it has its value as helping to complete in our minds the true type of the tyrant. The tyrant is he who uses public power as a private possession—uses it for his own gratification and not as a trust—and who can, therefore, stand apart in the hour of public

peril, and laugh at commotions which, fraught as they may seem with possibilities of general disaster, he gayly hopes will not dislodge him, personally, from his position of vantage.

The old doctrine was, that there could be but one tyrant in a state, one usurper of power; but if it be agreed that the essence of tyranny consists not in the *extent* of power usurped and abused, but in the *fact* of usurpation and abuse, we may perhaps be led to see that there may be as many usurpers or tyrants in the state as there are depositaries of power. He that is unfaithful in a little would be only too likely to be unfaithful in much, if he had the chance; at any rate he is in the same position morally and socially as though he had been unfaithful in much: he has done evil to the extent of his ability.

Let us look at the word "usurp" for a moment. The common and, as we think, correct etymology represents it as compounded of the two words *usui* and *rapere*, "to snatch for (one's own) use." Certainly a very happy mode of expressing the essential characteristic of tyranny. We load with opprobrium the monarchies of the past because they snatched to their own use and advantage powers which they could only righteously have wielded for the general good. We exult over the successive revolutions by which personal rulers have been shorn of their powers; and we look forward to the time when democracy in the fullest sense shall be co-extensive with civilization. Then no man will be the depositary of any wide powers except strictly as a matter of delegation. Then the whole people everywhere will co-operate in the making, and largely control the execution, of the laws; and tyranny will forever be at an end.

The prospect is a cheering one, but the subject will bear a little closer looking into. Let us suppose that a certain monarch of past times—an Alfred let us say, an Edward III, a William III, or, going further back, an Antonine or a Trajan—finding himself in the possession of supreme power in the state, had faithfully endeavored, according to his best lights, to use that power for the benefit of his subjects, regarding himself as responsible to some higher power enshrined in his own conscience—could such a ruler, acting on such principles, properly be called a tyrant? His reply to the charge, were it made, would be: "I have not made a selfish or irresponsible use of power; I have not sacrificed others to myself, rather have I sacrificed myself to others; I have done my *duty* to the best of my knowledge and ability." Now the question arises, Can the individual citizen, who disposes of his ballot and his social influence, always say as much? If not, what are we to say of him? Are we to say that, because political power which was once possessed in the lump by one man has been broken into fragments and distributed to all men, all need for responsibility in the use of it has vanished? We fail to see it. Formerly one man had much, and he was required to be faithful in much; now each of us has a little—of the very same thing be it remembered, power, power not over ourselves only, but over others as well—and surely we are required to be faithful in the exercise of that little. If we are not, what are we but each a petty tyrant in his way—fragments of one big tyrant, *disjecti membra tyranni*, if we may be allowed to alter a well-known Horatian phrase.

The man who sells his vote for money, what is he but a usurper in the strict sense—one who snatches a public function, and applies it to his purely private advantage? What is he, again, but a traitor, seeing that, for money, he hands over the government, so far as he can do it, to a public enemy—the purchaser of votes being of absolute necessity a public enemy? Well, every man will not exchange his vote for

hard cash; but many a man, who has a soul above that particular form of transaction, sees no harm in taking an office as the equivalent of his franchise. Another wants his particular line of industry protected, and subordinates everything to that, without so much as a qualm or a misgiving. If his vote was not given to him that he might use it for the advancement of his business interests, he does not understand anything about the matter. Others give their votes as a matter of private favor; others, again, under the influence of private spite. Most have no better reason to allege than that their party has set up this or that candidate, and that they mean to support the party nomination. The candidate may be a man they would not trust with their private cash, or put at the head of any financial institution in which they had a stake, but at the bidding of party they will vote him into any public position, district, State, or Federal. The party caucus gives a consecration more potent than any holy oil, wiping out scars, tattoo-marks, and every species of blemish, and making the nominee "good enough" to represent the nation in the very highest seat of power. A vote so used is not treated as a public trust; it becomes merely the means of gratifying the selfish spirit of faction.

The principle we contend for is this: that the measure we mete to the rulers of the past, and to all sole depositaries of power, we should mete to ourselves. We have the power now in our own hands; the question is, What have we done with it—what are we doing with it? We know unfortunately that thousands and hundreds of thousands of voters would utterly spurn the idea of any responsibility attaching to their use of the suffrage. In this matter we can not be saved by any "remnant." If the majority go wrong here, the whole nation will go wrong; and its public policy may be determined to most lamentable issues. If it be asked what all this has to do with the scientific interests which this magazine is understood to advocate, we would answer, in the first place, that the function of science, in that broad sense in which we understand it, is to give a wise direction to the whole of human life; and, secondly, that the interests of science are intimately involved in the general condition of public opinion and public morality. Both of these considerations we shall continue to elucidate and enforce; meantime, we would press upon each individual citizen the consideration, which there is no evading, that the exercise of all political power and influence is a sacred trust, and that it is no less shameful a thing for the citizen of a free republic to give his vote under the influence of private motives *apart from the sense of public duty*, than it was for any of the despots of old to have made their larger powers mainly subservient to their own gratification.

A JEWISH EXPLANATION OF JEWISH SUCCESS.

One of the best contributions to the discussion of the Jewish question, that we have seen, is the article of Mr. Lucien Wolf, himself a Jew, in a recent number of the "Fortnightly Review." Mr. Wolf takes the ground that the chief reason why the Jews have been hated and persecuted is that they have possessed a form of religion and a system of morals and of self-government which have given them an advantage over all other races in the battle of life. Taking up an expression of Mr. Goldwin Smith's, he admits that Judaism is a system of "legalism"; but he goes on to say that "legalism" is what is wanted for this world—method, adaptation of means to ends, of effort to conditions, careful preservation of all that tends to superiority, and equally careful removal of all that makes for inferiority, whether physical, mental,

or moral. He admits that Judaism is materialistic in this sense, that it concerns itself exclusively with the present life, and he maintains that, just because it does so limit the scope of its calculations and efforts, do things, so far as this world is concerned, go well with it. "The substantial difference," he observes, "between Judaism and Christianity is, that the one desires to teach us how to live, the other how to die. Judaism discourses of the excellence of temporal pleasure, the divinity—if I may be permitted to use the expression—of length of days; Christianity, on the other hand, emphasizes the excellence of sorrow and the divinity of death. It is no wonder, then," he continues, "if, when competition arises between a race trained and hardened for worldly conflict and communities who have been taught to regard it as a duty to lay up their chief treasure in another world and to despise this, success should fall to the former rather than to the latter."

There is probably a measure of truth in these views. The Jews have, on the whole, been objected to because they have been too thrifty. The complaint has not been that they could not keep up with the pace of the rest of the world, but rather that they had a pace of their own, with which the rest of the world found it difficult to keep up. It is true also that a great bane, perhaps the chief bane, of the Christian world, has been a want of adaptation of means to ends, and a certain indisposition to take the laws of life—particularly its physical laws—seriously. Whence, if not from this cause, the huge pauper population with which Christendom has ever been burdened? Whence the failures of every kind with which the whole extent of society is strewn? There are people by the thousand who do not know a fact when they see it. There are thousands who dash themselves against the irresistible, or seek to flee the inevitable, instead of recognizing that what must be must be, and that the part of wisdom is to bow to inexorable law and seek to make with it the best terms possible. The world abounds with incapacity arising apparently from a kind of fateful wrongheadedness. We have thinkers who can not act, and actors who can not think, and people overflowing with sentiment who do more mischief with their good intentions than others with their bad. We have nothing to do with any of the theological implications of Mr. Wolf's article—which we need hardly say was not written with any theological purpose—but we incline to think that the main lesson which it contains is one which even those who would repudiate those implications most strongly might well consent to learn. That lesson we take to be this: that so much of "materialism" as consists in taking a clear view and firm grasp of facts, and in looking to facts rather than to fancies or sentiments for guidance, constitutes an important element of success in life, and should be so recognized in every scheme of education. To organize education, indeed, on any other basis, is but to invite failure, defeat, and misery. Whatever superiority may be assigned to the spiritual nature of man as contrasted with his physical part, the dependence of the former on the latter can hardly be questioned. When the bodily estate sinks into wretchedness, the moral character too often finds the same level. On every ground, therefore, we want a system of teaching that will help a man to help himself, thus providing at once for his physical comfort, his self-respect, and his intellectual and moral development. Mr. Spencer has said all this, as well as it can be said, in his treatise on education; and Mr. Lucien Wolf, following a very different path, and with very different objects in view, brings us again face to face with truths which we can not take too seriously to heart.

LITERARY NOTICES.

THE RELATIONS BETWEEN RELIGION AND SCIENCE. Eight Lectures preached before the University of Oxford in the Year 1884, on the Foundation of the late Rev. JOHN BAMPTON, M. A., Canon of Salisbury, by the Right Rev. Lord Bishop of Exeter. New York: Macmillan & Co. Pp. 252. Price, $1.50.

It is now upward of a century since the Rev. John Bampton bequeathed his lands and estates to the authorities of Oxford University, the income of which was to be used forever in paying for a course of eight annual sermons or lectures devoted to the following objects: "To confirm and establish the Christian faith, and to confute all heretics and schismatics; upon the divine authority of the Holy Scriptures; upon the authority of the writings of the primitive fathers, as to the faith and practice of the primitive Church; upon the divinity of our Lord and Saviour Jesus Christ; upon the divinity of the Holy Ghost; upon the Articles of the Christian Faith, as comprehended in the Apostles' and Nicene Creeds."

If the well-intentioned founder of the celebrated Bampton Lectures could have foreseen what would be the result of a hundred years' experience in confirming the Christian faith and confuting heretics, according to the plan laid down, it is more than doubtful if he would have ventured upon the experiment. Had it been possible for him even to dream as to what sort of lectures his estate would pay for in one hundred and four years, he would have shrunk with horror from the awful result. For, although nothing more earnest or able or wise in defense of Christianity has been given by any of his predecessors than this last series of discussions by Dr. Temple, yet such has been the revolution of theological thought in a century that his book, if it had appeared in 1780, would have been execrated as the rankest conceivable infidelity. And yet, we repeat, no more skillful or powerful defense of fundamental Christian doctrine than these last Bampton Lectures has appeared in a long time. But the issues have been profoundly changed; and theological ground has been abandoned which a hundred years ago was regarded as the most essential part of the Christian faith.

There are of course plenty of living theologians who stick by the old—and the older the better—and with whom the intellectual progress of the last century goes for nothing. But among these the Bishop of Exeter does not belong. He is a liberal-minded, conscientious, and thoroughly trained thinker, who recognizes the tendencies and fully grasps the great results of modern scientific progress, which has opened a new world of truth to the human mind, and altered the point of view from which all the highest questions of human concernment are to be regarded. Instead of deploring the tendencies of advanced inquiry, and dreading the consequences of that deep and unwearying study of nature which characterizes our age, he regards it as something not to be reluctantly accepted, but to be welcomed and rejoiced in as the working out of a great providential dispensation. His lectures are characterized by this lofty and catholic spirit. They are widely contrasted in tone with that theological narrowness which has hitherto marked the controversial work of divines on the questions of the relations of religion and science.

We are here speaking of the temper and quality of Dr. Temple's work as a professed theologian, and not of the logical character of his argument. That will be regarded by many as in various points unsatisfactory. The work is highly instructive, and much important light is thrown on numerous points of controversy. But our chief interest in it is its striking significance in marking the progress of religious liberality. His attitude toward science is thoroughly untheological, using that term in its past and generally accepted sense. Dr. Temple professes his belief in miracles, but he declares that "Science can never, in its character of Science, admit that a miracle has happened." But he holds that all alleged miracles, on some possibly higher view yet to be reached, may disappear as miracles, and be shown conformed to a more enlarged view of the natural order. We may say generally that the force of his reasoning is derived from the present limitations and incompleteness of scientific truth.

It is especially noteworthy that the Lord Bishop of Exeter broadly accepts the doctrine of evolution. But it is not enough to

say that he merely accepts it. He maintains that it is not irreligious, that it is not hostile to Christianity; but, on the contrary, is the highest and noblest view of the universe, that it exalts the Divine character, and is, in fact, a great revelation, which among its many grand effects must exert an elevating and ennobling influence upon religious thought. We print a portion of the bishop's argument, which bears upon this question, in the present number of the "Monthly."

COTTAGES; OR, HINTS ON ECONOMICAL BUILDING. Compiled and edited by A. W. BRUNNER, Architect. New York: William T. Comstock. Pp. 54, with Twenty-three Plates.

THE plans given in this book are intended to respond to a change which the author conceives to have come within the past few years over our conception of what a country home should be. "Simplicity, elegance, and refinement of design are demanded, and outward display, overloading with cheap ornamentation, is no longer in favor. . . . Now that English gables and dormers have spread so widely; now that we realize the beauty of our own colonial architecture, and that the Queen Anne craze is subsiding so that only its best features remain, the less ambitious dwellings must not be left to the mercy of those builders whose ideas of beauty are limited to scroll-saw brackets and French roofs." The designs are presented to show what can be done with modest means, and have been contributed by different New York architects. They are accompanied by a descriptive letterpress giving practical suggestions for cottage building, and are supplemented by a chapter on heating, ventilation, drainage, etc., by William Paul Gerhard.

COMMENTARIES ON LAW. By FRANCIS WHARTON, LL. D. Philadelphia: Kay & Brother. Pp. 856.

DR. WHARTON, member of the Institute of International Law, is known as the author of several works on jurisprudence which have attained a high repute in the legal profession. The present treatise is a kind of introduction to the general subject of law and its authority, and embraces chapters on "The Nature, the Source, and the History of Law; on International Law, Public and Private; and on Constitutional and Statutory Law." It might be as well, while we are revising our courses of school and college instruction, to make some provision for teaching the people what law really is, and upon what it rests; for there seems to be nothing on which their minds are more at sea, and on which American citizens are more in need of sound instruction. Those who believe that it is anything that Legislatures may enact and interested parties try to evade—and there are apparently many such—will find new light shed upon the subject by the perusal of Dr. Wharton's book. Here the principle is asserted, and illustrated in discussion and citations, that "law as a rule of action is the product of the nation by which it is adopted," the nation not acting intermittingly and at particular times, but developing its statutes in the regular course of its life. "The laws which are really operative, and of which all efficient and enduring statutes are merely declaratory, are emanations rather than efforts; are the products and not the molders of custom; are the instinctive and unconscious outgrowth of the nation, and not the creatures either of *a priori* political speculation or of arbitrary sovereign decree"; and that not only must law both precede and define sovereignty, but "no law imposed by a sovereign can be permanently operative, unless it is declaratory of existing conditions."

DISEASES OF THE THROAT AND NOSE. By MORELL MACKENZIE, M. D. Vol. II. Philadelphia: P. Blakiston, Son & Co. Pp. 550. Price, $4.

ASIDE from the scientific value of its discussions and the adequacy of treatment, there is one feature of this book that deserves unalloyed commendation. "It is now twelve years," says the author, "since this work was commenced, and during that period there is scarcely a page that has not been written and rewritten several times." The treatise is intended to include affections of the pharynx, larynx, trachea, œsophagus, nose, and naso-pharynx. The present volume embraces diseases of the œsophagus, nose, and naso-pharynx, with an index of authors and formulas for topical remedies. Each kind of affection is taken up separately, and subjected to a full treatment in all

of its aspects. The author has had an "unrivaled experience" of twenty years' practice in the class of diseases of which he treats; and this, with the conscientious labor he confesses to have put upon it, seems to be all that should be needed to certify it a work of most eminent merit and value.

AN OUTLINE OF THE FUTURE RELIGION OF THE WORLD. With a Consideration of the Facts and Doctrines on which it will probably be based. By T. LLOYD STANLEY. New York: G. P. Putnam's Sons. Pp. 588. Price, $3.

THE author assumes that theological criticism having demonstrated the unsound foundations of many of the hitherto received dogmatic beliefs, it is in place to indicate a philosophically sound basis for religious trust in the future. The Hebrew, Vedic, Zoroastrian and Buddhist religious systems are reviewed, in a spirit friendly to all; the Christian system is considered at greater length, as superior to them all, and the conclusion arrived at that the world's religion of the future is destined "to rest mainly on the teaching of Christ, as that teaching becomes separated by criticism from the additions made to it by his disciples and by the early Church, and more fully expounded and understood. The Great Unity, the Unity of Life, physical and spiritual, will be recognized as a prominent feature of the Master's teaching. But the Christianity of the future will be relieved from the incubus of the marvelous and the legendary." This Principle of Life—"that all lives form part of one endlessly progressive Universal Life, culminating in Supreme Mind"—is asserted to be the essential truth of religion, "whose law is declared by the voice of conscience in each heart," and has been expounded as altruism.

MINERAL RESOURCES OF THE UNITED STATES. By ALBERT WILLIAMS, Jr. Washington: Government Printing-Office. Pp. 813.

THIS is one of the reports of the United States Geological Survey. The statistical department contains a section devoted to each of the economical minerals of the country, of length and fullness proportioned to the importance of the mineral and the magnitude of its commercial production. This is followed by special papers on "The Divining Rod," by R. W. Raymond; "Electrolysis in the Metallurgy of Copper, Lead, Zinc, and other Metals," by C. O. Mailloux"; "The Minor Minerals of North Carolina," by W. C. Kerr"; "Minor Minerals of the Pacific Coast"; and a table of localities of the useful minerals of the United States.

EDUCATION BY DOING. By ANNA JOHNSON. New York: E. L. Kellogg & Co. Pp. 109.

THE author of this manual is a teacher in the Children's Aid Society schools of this city. Believing that Froebel's discovery of education by occupation is capable of being extended to the public school and adapted to a later age, she has endeavored to show some of the ways and suggest others in which the children may be kept pleasantly and profitably employed. We have in the course exercises with blocks, beans, cards, pins, shoe-pegs, etc., to teach number; similar exercises with appropriate tools to teach weights and measures, form and geography, and color and form; exercises with pictures and cards to teach language; "busy work" to teach reading, writing, spelling, and correct speech; and miscellaneous exercises and "slate-work."

LIFE AND LABOR IN THE FAR, FAR WEST. Notes of a Tour in the Western States, British Columbia, Manitoba, and the Northwest Territory. By W. HENRY BARNEBY. London and New York: Cassell & Co. Pp. 432. Price, $2.

MR. BARNEBY is a young Englishman, with not much experience in literary work, but a good traveler. With two companions he traveled in 1883 through the regions named, saw much that was new to him, though it might not all be new to older travelers, and enjoyed his trip. He made regular notes of what he saw and sent them to his wife, who set them down in a book. The value of the sketches lies in the unaffected accuracy with which the author's off-hand impressions are recorded. Some suggestive glimpses are given of conditions of frontier life that are being pushed farther and farther away from the States. There is, for instance, the British Columbian justice, who, when he had to preserve order at Cariboo during the gold-fever, did it so well that he was said to spend his leisure hours on

Sunday looking out for trees on which to hang criminals on Monday; and there is a story of a photographer in Washington Territory "taking views" of the lynchers hanging some men, and "making quite a pile" by the sale of copies. The descriptions of country and scenery are terse and definite, and something may be gathered from the narrative concerning the economical value of the various districts to which it relates.

CORRESPONDENCES OF THE BIBLE. THE ANIMALS. By JOHN WORCESTER. Boston: Massachusetts New Church Union. Pp. 294.

IN the view of the author of this book, "the natural objects of the world about us are images, or manifestations to bodily sense, of the spiritual things in human minds. . . . Every branch of science, with all the particulars of it, is a physical emblem of deeper things than itself; and, if interiorly opened, it presents to our view a corresponding branch of spiritual science, with its particulars . . . Common speech testifies to a general recognition of relationship between animals and human feelings"—as when we emblematically use the names of different animals in describing various human qualities. The traits and peculiarities of all the animals named in the Bible are considered under this aspect.

GEOLOGY AND MINERAL RESOURCES OF THE JAMES RIVER VALLEY, VIRGINIA. By J. L. CAMPBELL, LL. D. New York: G. P. Putnam's Sons. Pp. 119, with Map and Geological Sections.

THE object of the author of this report is to lay before the minds of capitalists, immigrants, his fellow-citizens, and others who are interested in Virginia, "a concise yet comprehensive statement of the great extent and variety of available resources within the area under review, which only await capital, enterprise, and labor, to make them productive." The report reveals a great wealth in iron-ores, limestones, and forest products, with manganese, gold, slates, granite, steatite, mica, kaolin, barytes, white-sand, and asbestus, which are doubtless destined to have a large development in the future, and which are brought within reach of the market by means of the Richmond and Alleghany Railroad.

ARITHMETICAL AIDS. Boston: Houghton, Mifflin & Co. In box.

THE "Aids" consist of single counters and strips of ten counters each, and of cards expressing quantities of goods supposed to be sold, and values. The counters are used in solving problems in the four arithmetical rules; the goods-cards furnish stock to the pupil, who is supposed to keep a store; and the value-cards represent money in the hands of the supposed buyer of the goods. By a judicious use of the two kinds of cards, with the addition of such other goods-cards as it may suit the players to devise, all the transactions of store-keeping can be performed. Thus exercises in the learning of business, as well as amusement, may be had out of the Aids. A tract packed in the box explains the use of the Aids, and gives suggestions of other "arithmetical diversions."

A GRAMMAR OF THE GERMAN LANGUAGE. For High-Schools and Colleges. By H. C. G. BRANDT. New York: G. P. Putnam's Sons. Pp. 278. Price, $1.50.

THIS grammar, which is designed both for beginners and advanced students, embodies the results of philological research during the last twenty years, so far as it concerns the German language, and draws from the works of eminent modern writers on the subject. From the brief examination we have been able to give it, it strikes us as a systematic and well-matured work, that can not fail to be useful to those who wish to study the language critically.

A READER OF GERMAN LITERATURE. Prepared, with Notes, by W. H. ROSENSTENGEL. New York: G. P. Putnam's Sons. Pp. 402. Price, $1.50.

THE Reader is intended for students who have mastered a German grammar and an elementary reader, and are at home in using the dictionary. It aims to confine the selections to masterpieces; to give a full representation to modern literature; to add selections from the best and latest works on German history and the history of the civilization and language of the country; and to set forth accurate texts. Biographical sketches are given of some of the authors, and analyses of the more important works quoted from; and a chronology of German literature is added.

TABLEAUX DE LA RÉVOLUTION FRANÇAISE (Pictures of the French Revolution). Edited, with Notes, by T. F. CRANE and S. J. BRUN. New York: G. P. Putnam's Sons. Pp. 311. Price, $1.50.

THE object of this volume is to furnish the student with French reading of not a difficult nature, and at the same time to give some insight into the great historical epoch to which it relates. It does not give a continuous history of the Revolution, but a series of sketches, the gaps between which can easily be filled up, and it closes with the end of the Reign of Terror. We are surprised not to find the name of Lamartine among the authors quoted from.

ELEMENTS OF ANALYTIC GEOMETRY. By SIMON NEWCOMB. New York: Henry Holt & Co. Pp. 356. Price, $1.50.

PROFESSOR NEWCOMB has endeavored to arrange this work so that it shall be adapted both to those who do and to those who do not wish to make a special study of advanced mathematics. Beginning with a summary of the new ideas associated with the use of algebraic language, which the student is to encounter, it gives the usual college course in plane analytic geometry; a part on geometry of three dimensions; and an introduction to the modern projective geometry.

REPORT OF THE BOARD OF REGENTS OF THE SMITHSONIAN INSTITUTION FOR 1882. Pp. 855. Washington: Government Printing-Office. 1884.

THIS volume contains reports of the Executive Committee of the Board of Regents and of the Secretary of the Institution, the latter being an extended summary of the work done during the year by the various scientific departments connected with the Institution. It contains also a "Record of Recent Scientific Progress," and numerous anthropological papers, some of which are illustrated, nearly all describing excavations in ancient American mounds.

PUBLICATIONS RECEIVED.

Mental Contagion in Inebriety. By T. D. Crothers, M. D., Hartford, Conn. Pp. 9.

Public Relief and Private Charity. By Josephine Shaw Lowell. New York: G. P. Putnam's Sons. Pp. 111. 40 cents.

Religious Unrest. By M. J. Savage. Boston: George H. Ellis. Pp. 14.

The Late Attacks upon the Coast and Geodetic Survey. Philadelphia: L. R. Hamersley & Co. Pp. 52.

International Health Exhibition. Catalogue of Exhibits of the Department of Education, Empire of Japan. Pp. 80. General Outlines of Education in Japan. Pp. 29. London: William Clowes & Co.

The Ellipticon. By J. L. Naish. New York: John Wiley & Sons. Two-page Chart.

"The Canadian Record of Science." Vol. I. No. 1, Quarterly. Montreal: Dawson Brothers. Pp. 64. $3 for eight numbers.

A Sketch of the Geology of Philadelphia and its Surroundings. By Professor Angelo Heilprin. Pp. 6, with Map.

A Contribution to the Study of Coryza Vasomotoria Periodica, or "Hay-Fever." By John N. Mackenzie, M. D. Pp. 16.

Notes on Injurious Insects. From the Entomological Laboratory of the Michigan Agricultural College. Pp. 31.

Transactions of the Medical and Chirurgical Faculty of the State of Maryland. Baltimore, April, 1884. G. Lane Taneyhill, Secretary. Pp. 248.

Protection and Communism. By William Rathbone. New York: G. P. Putnam's Sons. Pp. 42. 10 cents.

Home School for Physical Culture. D. L. Dowd, 19 East Fourteenth Street, New York. Pp. 24.

Microscopic Observations on Internal Parasites in Fowls and on Butter and Fats. By Thomas Taylor, M. D. Washington: Department of Agriculture. Pp. 7.

Sponge Spicules; A Supposed New Species of Cristatella. By Edward Potts, Philadelphia. Pp. 12, with Plate.

The Azoic System and its Proposed Subdivisions. By J. D. Whitney and M. E. Wadsworth, Cambridge Museum of Comparative Zoölogy. Pp. 260.

National Educational Association, Department of Superintendence, February, 1884. Washington: Government Printing-Office. Pp. 176.

Bureau of Statistics, Treasury Department, Quarterly Report to June 30, 1884. Washington: Government Printing-Office. Pp. 160.

The Effect of Wind-Currents on Rainfall. By G. E. Curtis, Signal Corps, U. S. Army. Washington: Signal-Office. Pp. 11.

Finley's Tornado Predictions. By G. K. Gilbert. Detroit, Mich.: W. H. Burr & Co. Pp. 8.

The Miner's Fund of New Almaden. By Samuel B. Christy, Berkeley, Cal. Pp. 8.

American Society of Civil Engineers. Address of President J. D. Whittemore. Pp. 13.

How to Study. By Professor S. T. Skidmore, Philadelphia. Pp. 16.

Suggestions for computing the Speed of Chemical Reactions. By Robert B. Warder, North Bend, Ohio. Pp. 4.

Emblematic Mounds. By Stephen B. Peet. Pp. 68.

Sex in Mind and in Education. By Henry Maudsley, M. D. Syracuse, N. Y.: C. W. Bardeen. Pp. 36. 10 cents.

Bulletin of the Bussey Institution, Harvard University. Boston: John Allyn. Pp. 120. 75 cents.

Papers on American Grasses. By Dr. George Vasey and Clifford Richardson. Washington: U. S. Department of Agriculture. Pp. 144, with 120 Plates.

Ottawa Field Naturalists' Club. Transactions, No. 5. Ottawa, Can.: Citizen Printing and Publishing Company. Pp. 152.

Catalogue of North American Hepaticæ. By Lucien M. Underwood. Peoria, Ill.: J. W. Franks & Sons. Pp. 133.

The Human Body, and how to take Care of it. By James Johonnot and Eugene Bouton. New York: D. Appleton & Co. Pp. 162. 50 cents.

Book of Cats and Dogs and other Friends. By James Johonnot. New York: D. Appleton & Co. Pp. 96 20 cents.

A Compend of Geology. By Joseph Le Conte. New York: D. Appleton & Co. Pp. 399. $1.50.

Forestry of the Ural Mountains. Compiled by John Croumbie Brown. Edinburgh: Oliver & Boyd; Montreal: Dawson Brothers. Pp. 182.

Occult Science in India and among the Ancients. By Louis Jacolliot. New York: John W. Lovell & Co. Pp. 275.

Icaria: A Chapter in the History of Communism. By Albert Shaw, Ph. D. New York: G. P. Putnam's Sons. Pp. 219. $1.

My Farm at Edgewood. By the author of "Reveries of a Bachelor." New York: Charles Scribner's Sons. Pp. 389. $1.25.

Country Cousins. By Ernest Ingersoll. New York: Harper & Brothers. Pp. 252.

U. S. Life-Saving Service. Report for 1883. Washington: Government Printing-Office. Pp. 519.

There was once a Man. By R. H. Newell. New York: Fords, Howard & Hulbert. Pp. 526. $1.50.

An Appeal to Cæsar. By Albion W. Tourgee. New York: Fords, Howard & Hulbert. Pp. 422. $1.

Black and White. By T. Thomas Fortune. New York: Fords, Howard & Hulbert. Pp. 310. $1.

The Physician's Visiting List for 1885. Philadelphia: P. Blakiston, Son & Co.

The Northern Sugar Industry during the Season of 1883. By H. W. Wiley. Pp. 120, with 11 Charts. Composition of American Wheat and Corn. Second report by Clifford Richardson. Pp. 98. Washington: Department of Agriculture, Bureau of Chemistry.

Popular Fallacies regarding Precious-Metal Ore-Deposits. By Albert Williams, Jr. Pp. 16.

Comprehensive Anatomy, Physiology, and Hygiene. By John C. Cutter, M.D. Philadelphia: J. B. Lippincott & Co. Pp. 376. $1.

The Eclectic Physiology. By Eli F. Brown, M.D. Cincinnati and New York: Van Antwerp, Bragg & Co. Pp. 189.

A Thousand Questions on American History. Syracuse, N. Y.: C. W. Bardeen. Pp. 247.

Bread-Making. By T. N. T. New York: G. P. Putnam's Sons. Pp. 64. 50 cents.

The Lock-Jaw of Infants. By J. F. Hartigan, M.D. New York: Bermingham & Co. Pp. 123.

Outlines of Roman Law. By William C. Morey, Ph. D. New York: G. P. Putnam's Sons. Pp. 433. $1.75.

Report of the Commissioner of Education. 1882–'83. Washington: Government Printing-Office. Pp. 872.

Magneto- and Dynamo-Electric Machines. By Dr. H. Schellen. New York: D. Van Nostrand. Pp. 518.

Our Birds and their Haunts. By the Rev. J. Hibbert Langille. Boston: S. E. Cassino & Co. Pp. 624.

A Migration Legend of the Creek Indians. By Albert S. Gatschet. Vol. I. Philadelphia: D. G. Brinton. Pp. 251.

A System of Psychology. By Daniel Greenleaf Thompson. London: Longmans, Green & Co. Two vols. Pp. 613 and 589. 36s.

The Destiny of Man viewed in the Light of his Origin. By John Fisk. Boston: Houghton, Mifflin & Co. 1884. Pp. 121. $1.

Thomas Carlyle: A History of his Life in London, 1834–1881. By James Anthony Froude, M. A. New York: Charles Scribner's Sons. 1884. Pp. 417. $1.50.

POPULAR MISCELLANY.

American Association Addresses.—Professor J. W. Langley's vice-presidential address before the Chemical Section of the American Association was on "Chemical Affinity." He opened his paper with a review of the various theories that had been proposed to account for chemical action from Hippocrates down, and showed how the term "affinity" has disappeared from the chemical literature of the present day. Three methods of studying the force of affinity have been taken up and followed in parallel courses, which may be designated as the thermal, the electrical, and the method of time or speed. It is deduced from thermochemical phenomena that the work of chemical combination is largely influenced by the surrounding conditions of temperature, pressure, and volume, and that the force of affinity is dependent on the conditions exterior to the reacting system which limit the possible amount of change. The electrical method has been followed less actively than the thermal one, and has not led to any particularly definite results. Very little work has been done in the method of time or speed of chemical reaction, in which, however, Professor Langley suggests that the future of chemical research may lie. Chemistry is behind physics, in that it is served by only two fundamental conceptions—mass and volume—while physics is underlain by three—space, mass, time. What would physics be without the notation of velocities? such in a measure is chemistry without taking account of dynamics. Whenever we look outside of chemistry, we find that the lines of the great theories along which progress is making are those of dynamic hypotheses. So it is in biology, in geology, and in physiology, where all observations are made in the light of time-indications; and so it must be in chemistry. "The study of the speed of reaction has but just begun. It is a line of work surrounded with unusual difficulties, but it contains a rich store of promise."

In his address before the Geological and Geographical Section on "The Crystalline Rocks of the Northwest," Professor N. H. Winchell presented some considerations in favor of recognizing and adopting in Ameri-

can geology the Taconic group which was set forth by Dr. Emmons in 1842. Until very recently it has been the practice of geologists to refer every crystalline rock in the Northwest—in Michigan, Wisconsin, and later in Minnesota—to either the Huronian or Laurentian system. A more careful examination has shown that the nomenclature is imperfect, and needs to be amended or supplemented. Omitting the igneous rocks of dikes and overflows, the crystalline rocks underlying the shales and sandstones of the cupriferous formation in the Northwest may be arranged, in descending order, in six groups. The first group consists of granite and gneiss with gabbro, and has been variously regarded by different geologists. Below this is a series of strata that may be designated by the general term *mica-schist group.* Next is a group of black mica-schists, with carbonaceous and arenaceous black shales, under which is a very thick series of obscure hydromicaceous and greenish magnesian schists, with beds of gray quartzite and clay slates and deposits of hematite iron-ore, terminating with magnetic iron-ore. The fifth group consists of gray quartzite and marble, and rests upon the lowest recognized horizon of granite and syenite, with hornblendic schists. Difficulties rise when it is attempted to find correspondences between these groups and any of the now recognized Eastern formations. Dr. Emmons erred in his first presentation of the Taconic system by extending it geographically too far east, and choosing a name for it which is appropriate only to a part of that eastward extension, and for that reason, perhaps, among others, it has fallen out of favor. In Professor Winchell's view, however, his claim, "in all its essential points, remains intact." This consists in the existence of a series of sedimentary deposits, largely metamorphic, below the Potsdam sandstone, and separating the Potsdam from the crystalline rocks known as "primary" in an orderly chronological sequence. His system, going from the top down, comprised a black slate, including a considerable amount of carbonaceous matter; an argillaceous, siliceous, and "talcose" *Taconic slate;* the "Stockbridge limestone"; graduating downward into "talcose" or magnesian sandstones and slates; a "granular quartz-rock," with slates and becoming in some places a conglomerate with a "chloritic paste"; and the "ancient gneiss" on which the formation rested unconformably. In this several correspondences are found with the definitions of the crystalline rocks of the Northwest. Professor Winchell concludes that Dr. Emmons's Taconic included three of the six groups of the Northwest; that the Huronian of Canada is the equivalent of the lowest of the Taconic groups, and the perfect parallel of only the lowest of the groups in the Northwest that have been designated Huronian; that the uppermost of the groups in the Northwest is local in its existence and exceptional in its characters, and has therefore received a variety of names; and that there are, therefore, confusion and conflict of authority in the application of names to the crystalline rocks of the Northwest.

Professor Cope chose, as the subject of his address before the Biological Section, catagenesis, or the doctrine of the process of creation by the retrograde metamorphosis of energy, or by the specialization of energy. He began his argument by assuming that the general proposition that life has preceded organization in the order of time may be regarded as established; for it follows necessarily from the fact that the simple forms have as a rule preceded the complex in the order of appearance on the earth. Consciousness is coeval with life and has preceded all action, even such actions, called automatic and reflex, as are now performed in incomplete or complete unconsciousness. They were performed for the first time consciously and of design, but by frequent repetition they became habitual, and consciousness finally disappeared. Life, then, may be defined as energy directed by sensibility, or by a mechanism which has originated under the direction of sensibility. Consciousness is a property of matter, although clearly not of all kinds of matter. It is, then, of course subject to the laws of necessity to which matter and energy conform. The key to many weighty and mysterious phenomena of animal life can be found in the fact that energy can be conscious; but, when energy has become automatic, it is no longer conscious, or is about to become unconscious. In animals, with the development of habit,

energy, on the loss of consciousness, undergoes a retrograde metamorphosis, as it does later in the history of organized beings on their death. This loss of consciousness is first succeeded by the so-called involuntary and automatic functions of animals. According to the law of catagenesis, the vegetative and other vital functions of animals and plants are a later product of the retrograde metamorphosis of energy. Yet the conscious animal kingdom is dependent on the unconscious vegetative, and the living vegetative on the dead inorganic kingdom, for nutrition, and consequently for existence. So the animal organism could not have existed prior to the vegetable nor the vegetable to the mineral. The explanation of this paradox is found in the wide application of the "doctrine of the unspecialized," in the light of which creation consists in specialization, or in the specific action of Spencer's general principle of the conversion of the homogeneous into the heterogeneous. The material basis of consciousness must, then, be a generalized substance which does not display the more automatic and the polar forms of energy, and is found in protoplasm. This is manufactured by living plants out of inorganic matter. For the first production of it, the generative energy must have previously existed in some form of matter not protoplasm, the detection of which must be left to future research. Both vegetable and animal kingdoms have been derived from the simplest of beings, some of whose forms may be still among us. The vegetable kingdom consists of organisms which consciousness has abandoned, and which have become automatic, sessile, parasitic, more automatic and degenerate. "The animal line may have originated in this wise: some individual protists, perhaps accidentally, devoured some of their fellows. The easy nutrition which ensued was probably pleasurable, and once enjoyed was repeated, and soon became a habit. The excess of energy thus saved from the laborious process of making protoplasm was available as the vehicle of an extended consciousness. From that day to this, consciousness has abandoned few if any members of the animal kingdom. In many of them it has specialized into more or less mind." If the principles here adopted be true, it is highly probable that all forms of energy have originated in the process of running down or specialization from the primitive energy.

STUDENTS' LECTURE NOV 22

Professor Edward S. Morse, Vice-President of the Anthropological Section, made the existence of "Man in the Tertiaries" the subject of his address. He began by predicating that rational investigation of man's origin had been obstructed by self-created barriers, which had to be ascended and overthrown one after the other. One of these barriers, which was interwoven with theological dogma, was removed some time ago. The next barrier was the one erected by Cuvier, in the idea that man, being highest in development of the animals, must have been latest in origin, and therefore could not have been contemporary with any but present fauna. This was overthrown by the discovery of relics of quaternary man. The discovery of evidences of human existence in tertiary formations has also been discredited by Gaudry and Dawkins, because no species now extant existed then; and Dawkins adds that, if man had been living then, he must have been subjected since to changes commensurate with those which other animals have undergone. The idea has also prevailed that man has been evolved from the higher apes, and that his nearest relatives among those creatures are those which are supposed to have appeared last in the sequence. Evidences of man are, however, found associated with extinct apes, and the gap between the two organisms is by no means closed. The apes are distinctly apes, and the man, though with ape-like features, is still man. The first anthropoid ape appears to have been found in the Middle Eocene, and later still a more generalized form, Oreopithecus, having affinities with anthropoid apes, macaques, and baboons. Side by side with them are to be found chipped flints. The approach of the two groups, man and apes, which seem to have co-existed here, must be sought far back. Man must have existed long before he could have left any marks of his work, "for before the rudest flint was fashioned by him he must have used natural fragments of sticks and stones, and even this faculty must have indicated an advance far beyond that of his progenitors, who had not acquired even

the habit of handling weapons—the earliest evidences of man must be sought for in his remains, and not in his works," and here we meet difficulties, for the remains of man, being generally left in situations where they are exposed to decay, disturbance, or removal, are rarely found, even where the remnants of his works are numerous, as in the shell-mounds, caves, and lake villages. Hence, discovery of the remains of primitive man is highly improbable. That man has not changed in his physical characteristics in the same proportion as other animals is explainable by considering that the moment the ancestors of man possessed the power of banding together in communities, and of using weapons, they became capable of rendering inoperative the very influences which were so active in modifying or exterminating their mammalian associates. Cope has shown that the formation of man's feet is more like that of the earlier plantigrade type than that of the later ungulate and carnivorous types, in which the heel is lifted up. Man's structural relations are not only with the higher forms of apes, but also with those of the whole range from the gorilla down, and osteologically even with the half-apes and the lemuroids, which last have been discovered in the Lower Eocene of both continents. If these structural affinities are established, we must look far beyond and below the present higher apes for the diverging branches of man's ancestry. Another evidence of high antiquity is afforded by the wide dispersion of the points at which the remains of early man have been found. It must have taken an enormous period for a race so low in savagery to have acquired so extensive a range.

General John Eaton, Vice-President of the Section of Economic Science and Statistics, spoke on the value of "Scientific Methods and Scientific Knowledge in Common Affairs." There is no good reason, he said, why scientific men should neglect to apply scientific methods to the economy and statistics of every-day life. It is unfortunate that scientific men aspire so exclusively to original research. We need men to couple love of science with love of mankind. Is not benefit to mankind the real measure of the good that is in science? The scientific method of communicating truth recognizes the fact that man's powers are shaped, and too often the bulk of his knowledge is acquired, in early life. Hence its fundamental rule must be simplicity in the use of language, and in the presentation of each truth in the concrete. Adopted in the whole domain of scholastic instruction, it would bring new votaries to science, and a better taste for all kinds of literature would result. The progress of the race is tending toward a gathering up, for man's daily use, of all the lessons of Nature, and to their application for the prevention of disorders and the anticipation of the need of measures for cure. As balance-sheets are studied in business, so are questions of finance, of taxation, and public expenditure. Great operations demand and have their collections of statistics and their vast accumulations ready as communications to economic science. But the correlation of all these and their actual results have not yet been reached. Nevertheless, money sees the profits of this wisdom, and is more ready to pay for it.

The French Association.—The thirteenth meeting of the French Association for the Advancement of the Sciences was opened at Blois, September 3d. The capital fund of the Association was reported to amount to $100,000, and $1,500 had been applied to scientific researches. The President, M. Bouquet de la Grye, made the opening address, on the subject of the "Progress of Hydrography in France." He suggested that variations in the level of the sea might exist in consequence of differences in the saltness of the water producing variations in density, and of differences in temperature. The level of the Mediterranean should be lower than that of the ocean, because its water is more dense. An increase of temperature in the German Ocean would flood the coasts, and make Paris a seaport. Dr. Grimaux delivered a memorial address on the academicians who had died during the year. Mr. Bouley presented a paper on M. Pasteur's recent investigations. The Marquis de Rochambeau spoke on the archæological treasures of the Vendôme. A formal visitation was made by the members of the Association as a body to the statue of Denis Papin, who was a native of Blois, and

a wreath was placed at its feet. M. Tresca made the memorial address, and claimed for Papin the distinction of having been the inventor of the first steam-engine. Excursions were made to various places of interest, among them the strata of Thenay, where Abbé Bourgeois thinks he has discovered relics of tertiary man, and the Celtic caverns of Troû.

Discussions at the Electrical Conference.—An Electrical Conference sat in Philadelphia, in connection with the Electrical Exhibition, during the second week in September, and was attended by about one hundred and seventy-five American and foreign delegates. Professor Simon Newcomb opened the session with an address of welcome, after which the President of the Conference, Professor Henry A. Rowland, presented in his official address the subjects of the interdependence of applied and pure science, some of the questions still open in electrical science, and the need of more careful training in the theory of electricity in technical schools. The meetings of the Conference were continued, with discussions of the best methods of extending our knowledge of atmospheric electricity and earth-currents, and any possible relation that may exist between them and the weather, by Professor Abbe; the question of the establishment of a Bureau of Physical Standards, under the supervision of the Government, by Professor Snyder and other members of the Conference; the theory of the dynamo-electric machine, by Professor Rowland, with remarks by Professor Fitzgerald, of Dublin, and Professor Silvanus P. Thompson; the electrical transmission of energy, by Professor Nipher, of Washington University, St. Louis; storage-batteries, by Mr. W. H. Preece and Professor Dewar; and long-distance telephony. On the last subject Mr. T. D. Lockwood mentioned earth-currents, atmospheric electricity, imperfect contacts, and leakage from other lines, together with electro-static and electro-dynamic induction, as causes of the noises on telephone lines. Long lines are more subject to these troubles than short ones, and north and south lines than east and west ones. Sometimes one end of the line will be noisy and the other end quiet, as between Chicago and Milwaukee, where it is quiet at the Chicago end and noisy at Milwaukee. Lines subject to nearly uniform leakage are more quiet than well-insulated lines, lines near the sea than inland ones, and lines of small wire than lines of large wire. Many of the sources of disturbance may be got rid of by providing a metallic return-circuit, hung parallel to the first circuit and similarly to it. When a long air-line ends in a short underground cable, the person at the end of the cable can make himself heard, while the person at the end of the long line can not. Captain O. E. Michaelis recommended the study of iron, copper, brass, etc.—the metals used in structures—by electrical or magnetic methods—with a view to finding means of discovering defects and weaknesses. On the electrical protection of houses, Professor Rowland spoke well of the conductors enveloping the house as if they were a cage: thus, it is well to have the rods run down the four corners of the house and across the angles of the roof, joining at the top, so as to form the skeleton of the cage. Additional rods may also be run down the sides of the house. The rods must be well grounded, otherwise they will be worse than useless. Twisted rods are not recommended. Small rods, bearing points, should rise from the main rods at different points on the roof.

The Association of Official Chemists.—An Association of Official Chemists of the United States was organized during the meeting of the American Association. Chemists of the Department of Agriculture, State agricultural societies, and boards of official control, are eligible to membership in the Association, and each of the organizations thus represented is entitled to one vote on all matters on which the society may ballot, while other chemists are invited to attend the meetings and take part in the discussions, without having the right to vote. Three standing committees were appointed—on the determination of phosphoric acid, nitrogen, and potash—who will distribute samples for comparative work, and report the results at the annual or at special meetings. The following officers of the Association were elected: President, Professor S. W. Johnson, of Connecticut; Vice-President, Professor H. C. White, of Georgia;

Secretary and Treasurer, Dr. C. W. Dabney, Jr., of North Carolina. Dr. E. H. Jenkins, of Connecticut, and Dr. H. W. Wiley, of Washington, were constituted the Executive Committee. The annual meeting of the Association is to be held on the first Tuesday in September.

The Esquimaux and the Cave-Men.—Professor Boyd Dawkins presented before the British Association the considerations in favor of his theory that the Esquimaux are the survivors of the prehistoric "cave-dwellers." Everywhere the Esquimaux are found, he said, along the Arctic coasts of Greenland and America, and into Asia, they are a receding race. Mr. Dall has shown that they formerly dwelt on the west coast of America far south of their present abode, and the speaker has found evidence of their former presence south of their habitat in Asia. They present the appearance of being a distinct race. To find other men like them we have to go back to geologic times, to the cave-men, with whom they show several points of resemblance. Both dressed in skins and wore long gloves, were hunters and fishermen, showed considerable artistic taste and skill, and used implements of stone and bone. The Esquimaux do not bury their dead, and there are many reasons for believing that the cave-men did not. Other speakers questioned the force of Professor Dawkins's arguments. They held that the human remains found with the cave-dwellers' relics, which Professor Dawkins regarded as intrusive, were genuine, and that they represented a different physical structure from that of the Esquimaux; that other traits, insisted upon as common, were not peculiar to these two peoples alone; and that the reason the Esquimaux do not bury their dead is simply because the conditions of the climate do not often allow it. Lieutenant P. H. Ray gave reasons for believing that the Esquimaux had occupied the far north of America from a remote period. Snow-goggles, like those now in use, have been dug up twenty-eight feet below the surface of the ground. Mr. Ray believed the Esquimaux to be a people of the ice, living from extreme antiquity along the ice-border, and following it as it advanced or receded. He considered them distinct from the Indians in physical traits and in character, as well as in language. They were naturally a peaceful people, very superstitious, but without a distinct religion, and without the conception of a future existence. They did not bury their dead because the climate rendered it usually impossible, but merely conveyed the corpse to a distance from the village, and left it to be devoured by the dogs. That, they said, was the end of man. But they had ideas about a superior Being, who had created men and animals, and believed in an evil spirit.

NOTES.

From papers read in the British Association, it appears that the most important coal-fields in the Acadian or St. Lawrence basin are those of Cumberland, Pictou, and Cape Breton. The other coal-regions of the Dominion are one extending from the ninety-seventh parallel to the base of the Rocky Mountains, and one on Vancouver's Island. Of the three fields, the first is in the carboniferous, while the other two belong to the secondary or tertiary formations.

M. V. Magniant writes to the "Revue Scientifique" that he has a cat which shows signs of intelligent reflection. Not only does it look behind the mirror for the cat which it sees reflected in the glass, but it has been caught several times attentively regarding a sculptured cat's head that hangs on the wall. It would get upon the back of a chair, and then stand up and stretch out its paw to touch the image of itself. It has outgrown the sports of kittenhood, but when it is asked in the morning if it is hungry it emits two sounds, that clearly mean yes, with an articulation that is never heard under any other circumstances. It loves flowers, not eating them, but inhaling their perfume with a visible satisfaction.

Mining-Engineer Wenzel Poech, of Austria, has discovered a simple, cheap, and practicable means of preserving mineral coal from deterioration in the open air, where it is liable to crumbling, and oftentimes to spontaneous combustion. It consists principally in treating the coal-pile with steam for the exclusion of the air, and securing a permanent retention of moisture by the coal. The theory of the process is that the deterioration of coal is caused by its absorption of oxygen and other gases, for which the way is opened by the evaporation of the hygroscopic moisture. If the coal is kept full of water, this can not happen.

Professor Archibald stated, in the British Association, that the "Krakatoa committee" had succeeded in collecting much

information concerning the red sunsets and the diffusion of volcanic dust, which had not yet been examined; and he could only say that nothing had yet appeared which was inconsistent with the Krakatoa theory.

Dr. Lenz, of St. Petersburg, has devised a telephone for measuring temperatures at a distance. Suppose two stations, A and B, joined by two wires of iron and silver which are soldered at both ends. If the solderings differ in temperature, a thermo-electric current will circulate through the wires, and may be made to express itself by means of a telephonic apparatus; but if the observer, say at A, raises or reduces the temperature of the soldering at his end, till it is identical with the temperature at the end B, the telephone will cease to speak.

OBITUARY NOTES.

M. J. A. Barral, a distinguished French chemist and agronomist, died in September, in the sixty-sixth year of his age. He was Professor of Physics in the College of Sainte-Barbe. In 1850 he made an experimental balloon ascension with M. Bixio, to test the temperature and moisture of the air at different elevations. He founded the "Journal de l'Agriculture," and was commissioned by Arago editor of his works, which were published in seventeen volumes.

Professor J. C. Schioedte, a prominent Danish entomologist and editor of the "Naturhistorisk Tidskrift," of Copenhagen, is dead, at the age of sixty-nine years.

Mr. Charles Manby, engineer, who recently died in England, was for seventeen years paid secretary and for twenty-eight years honorary secretary of the Institution for Civil Engineers. He was the son of Aaron Manby, an eminent iron-manufacturer, and was engaged in the construction of the first pair of marine engines with oscillating cylinders and upon the building of the Aaron Manby, the first iron steamship that ever made a sea-voyage.

Baron Paul Thénard, the eminent French agricultural chemist, has recently died, in the sixty-fifth year of his age. He was a man of immense wealth, and employed it in the service of science. He was the author of investigations on phosphuretted hydrogen, the action of the electric spark in chemical combinations, and on numerous questions in agricultural chemistry; and he possessed extensive laboratories at Talmay and in Paris.

Mr. George Bentham, F. R. S., an eminent English botanist, died on the 10th of September last, in the eighty-fourth year of his age. He was a son of General Samuel (afterward Sir Samuel) Bentham, and a nephew of Jeremy Bentham, the famous economist. His attention was attracted to botany, while the family were living in France, by the perusal of De Candolle's "Flore Française," and he immediately took to the study of the flowers in the back yard. His studies were afterward of a more diversified character, while botany still led, till 1829, when he gave up the profession of the law for his favorite science. He studied the enormous collections of the East India Company which had been brought home by Wallich from India; worked out the flora of Hong-Kong and Australia, the latter in seven volumes, containing seven thousand species, for the Royal Gardens at Kew; revised the orders of the *Labiatæ*, *Scrophularinæ*, *Polygoneæ*, etc.; and composed, in association with Hooker, the "Genera Plantarum," a complete general work on the phanerogamic plants, which was completed in the spring of 1883. "He has left no equal," says "Nature," "except Asa Gray."

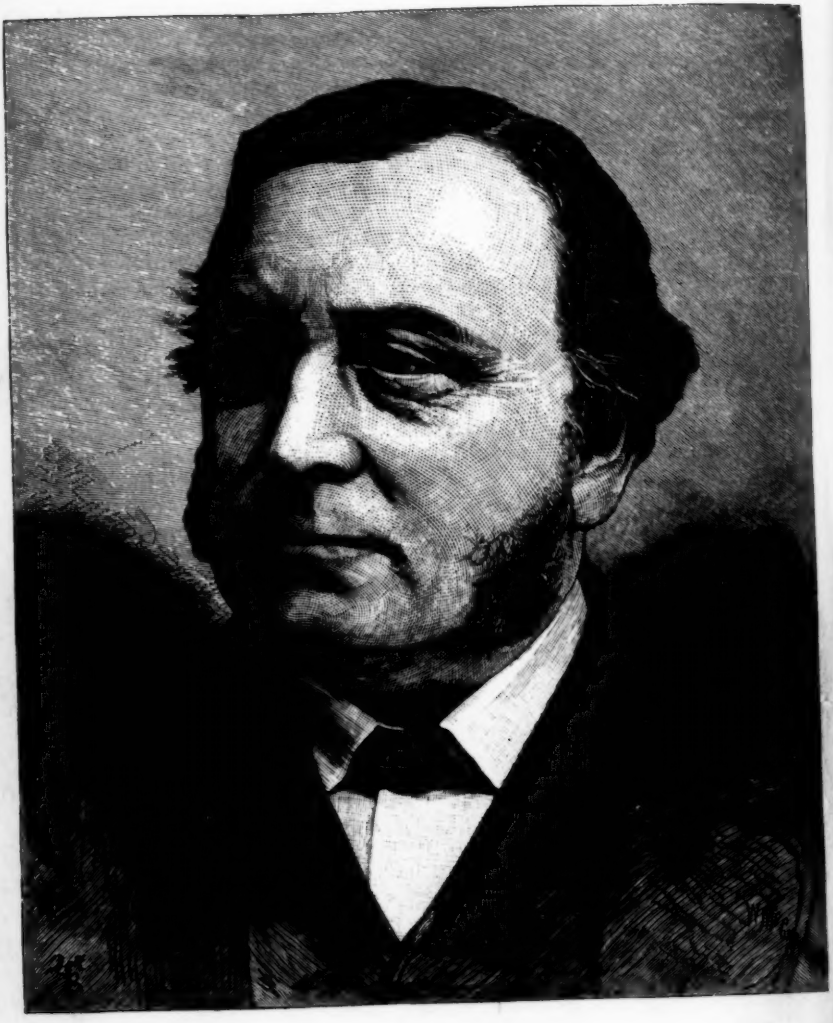
Dr. Joseph Anton Maximilian Perty, Professor of Zoölogy, Psychology, and Anthropology in the University of Berne, died on the 8th of August last, aged eighty years. He was a man of great literary activity in the fields of natural history and metaphysics. Among his works in the latter field were "A Universal Natural History," in four volumes, a treatise on the smallest forms of life, an introduction to the natural sciences, a text-book of zoölogy, outlines of ethnology, and books on anthropology and psychology.

The death of Dr. Heinrich Schellen, author of two well-known works on the electro-magnetic telegraph and spectrum analysis, is reported. Dr. Schellen was formerly director of the Cologne Realschule, and, besides the works named above, published an arithmetic, a German version of Padre Secchi's book on the sun, and other works on physical subjects. He was sixty-six years old.

M. Eugène Bourdon, inventor of the metallic barometer and manometer which are largely used, died in Paris on the 29th of September, aged seventy-six years.

Dr. Settari, an eminent entomologist (particularly in the department of Lepidoptera), has recently died at Meran, Tyrol.

Professor Jakob Natanson, a Polish chemist, died in Warsaw, September 16th. He wrote many scientific books in the Polish language, the most valuable of which were a text-book on chemistry and a treatise on organic chemistry; prepared carbamide synthetically in 1856; and improved the methods for determining the density of vapors.



HENRY ENFIELD ROSCOE.